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See also back page

1 F 13

[Testing plastics. Migration of cadmium pigments from food packaging materials.] Beitrag zur Prüfung von Bedarfsgegenständen aus Plasten. Über das Migrationsverhalten von Cadmiumpigmentfarbstoffen aus Lebensmittelverpackungen.

Woggon, H.; Köhler, U.; Uhde, W.-J.
Deutsche Lebensmittel-Rundschau 64 (8) 243-47 (1968) [11 ref. De, en, fr] [Inst. für Ernährung, Potsdam-Rehbrücke, E. Germany]

The extraction of soluble Cd from 3 types of plastics was examined. Various Cd colour pigments with soluble Cd contents from 0.01-5.0% were incorporated into the plastics, and the plastics were extracted with water and 5% acetic acid at 80°C, and with boiling ethanol and ether, all for 6 h. The Cd thus extracted was measured by polarography. When polythene and polystyrol were thus treated, only very small amounts of Cd were extracted from the various samples containing 1% of the pigments. From polyamide samples containing 0.3 - 0.5% of pigments, the amounts of Cd extracted by water, ethanol, and ether were also quite small, but considerable amounts were extracted by acetic acid, and by a 6% citric acid solution. From their data the authors suggest the following user limits: For polythene and polystyrol a max. of 1% pigment in the plastics, and a max. of 0.5% soluble Cd in the pigment; and for polyamides a max. of 0.01% soluble Cd in the pigment though they consider this latter limit not to be practical. AF

1 H 13

Determination of heavy metals in wines by atomic absorption spectrophotometry.

Meranger, J. C.; Somers, E.
Journal of the Association of Official Analytical Chemists 51 (4) 922-25 (1968) [10 ref. En] [Res. Lab., Food & Drug Directorate, Dept. of Nat. Health and Welfare, Ottawa, Ontario, Canada]

The effect of alcohol and sugar concn. on the atomic absorption analysis of Cu, Zn, Ni, Cr, Pb, Cd, and Co has been investigated. Sugar reduced the sensitivity of analysis but could be compensated for by using the method of additions. Interference from alcohol was avoided by introducing an evaporation stage, and the concn. of the above cations was determined by direct aspiration in 24 native and imported wines. AS

11 A 297

[Trace quantities of cadmium in foodstuffs of animal origin.] Spurenmengen von Kadmium in Nahrungsmitteln tierischen Herkunft.

Lener, J.; Bibr, B.
Vitalstoffe - Zivilisationskrankheiten 14 (3) 125-27 (1969) [28 ref. De, en, fr] [Hygiene Inst. Srobarova 48, Orag 10, Czechoslovakia]

The determination of Cd by substoichiometric isotope dilution is described. Analyses of beef and pork liver and beef and pork kidney gave 0.16, 0.88, 1.59 and 0.73 µg Cd/g fresh wt. respectively. Annual consumption of liver and kidney in Czechoslovakia is ~4.7 kg/capita, i.e. 4.10³ µg Cd. The authors conclude that the examined foodstuffs are not the main dietary source of Cd. RM

3 A 80

The determination of small amounts of cadmium in organic matter. [A report]

Coles, L. E. (United Kingdom, Society for Analytical Chemistry, Analytical Methods Committee) (Chairman)

Analyst 94 (1125) 1153-58 (1969) [6 ref. En]

The report recommends three methods (colorimetric, polarographic and atomic absorption) for the determination of cadmium. These methods are described in detail and results obtained from collaborative tests on samples of plastics material, orange squash and lime juice containing added cadmium are presented. MEG

6 H 645

[Metal content of preserved fruit juices.]

Gherardi, S.; Casoli, U.

Industria Conserve 44 (4) 296-99 (1969) [4 ref. It, en, fr, de]

According to a decision taken by the EEC-Codex Alimentarius Committee on fruit juices, a study was carried out by the Italian working group on the Cu, Fe, Zn, Pb, Sn, and Cd contents of industrial fruit juices. Juices of peach, apricot, pear, orange, myrtle berry, lemon, cherry, grape, apple, and blackcurrant, either bottled or canned in 1965, 1966 and 1968 were analysed by atomic absorption spectrophotometry. As expected, all the products contained levels of trace elements higher than those of corresponding fresh fruits, the increase being particularly large for Sn and Fe in aged canned products. CEB

7 M 597

Distribution of lead, tin, cadmium, chromium and selenium in wheat and wheat products.

Morris, E. R.; Greene, F. E.

Federation Proceedings. Federation of American Societies for Experimental Biology 29 (2) 500 (1970) [En] [Human Nutrition Res. Division, Agric. Res. Service, USDA, Beltsville, Maryland 20705, USA]

Pb, Sn, Cd, and Cr concn. were determined by atomic absorption spectrometry and Se by a colorimetric method in 9 wheat blends, flour milled from them and products baked from the flours. The average concn. of each element in 5 common hard and 4 soft wheat blends, respectively, were (ppm, dry basis) Pb, 0.50 and 1.00; Sn, 5.6 and 7.9; Cd, 0.10 and 0.07; Cr, 0.38 and 0.37; and Se in the hard wheats, 0.50. Concn. and % recovery, respectively, of each element in baker's patent flour milled from the hard wheat blends was Pb, 0.92 and 127%; Sn, 4.8 and 43%; Cd, 0.05 and 30%; Cr, 0.22 and 35%; and Se, 0.47 and 57%. Bread baked from these flours contained (ppm, dry basis) Pb, 0.47; Sn, 9.8; Cd, 0.22; Cr, 0.38; and Se, 0.41. Sources other than the flour contributed significant amounts of Sn, Cd and Cr to the breads. Pb, Sn, Cd and Cr concn. were also determined in composite samples of 10 different consumer products from 10 cities throughout the USA. Although there was statistically significant variation between geographical regions in the trace element content of some products, the data do not indicate regional variation in trace element nutrition due to consumption of wheat products. AS

8 C 192

[Normal Cd intake from foods and beverages.]
Usuelle Cadmiumbelastung durch Nahrungsmittel und Getränke.

Essing, H.-G.; Schaller, K.-H.; Szadkowski, D.; Lehnert, G.

Archiv für Hygiene und Bakteriologie 153 (6) 490-94 (1969) [26 ref. De, en, fr, es] [8520 Erlangen, Schillerstrasse 25, W. Germany]

Cd contents of 17 different foods purchased in W. Germany were determined in a series of 199 individual analyses. The foods were divided into the following categories: meat, fish, milk, eggs, edible fats, flour, potatoes, sugar, vegetables, fruits, beer, wine, coffee, tea and salt. Cd

contents and calculated per caput intake via the various foods are tabulated. Total per caput Cd intake in W. Germany is estimated at 48.45 µg/day. HBr

8 J 865

[Use of atomic absorption spectrophotometry for the determination of metals.]

Gherardi, S.; Casoli, U.

Industria Conserve 45 (1) 15-18 (1970) [6 ref. It, fr, en, de] [Sta. Sperimentale per l'Ind. delle Conserve Alimentari, Parma, Italy]

The determination of Cu, Zn, Fe, Sn and Cd in fruit nectars by atomic absorption spectrophotometry was studied. The most suitable methods for removing organic materials were found to be dry ashing and wet oxidation with HNO₃ and H₂SO₄. Accurate and reproducible results were obtained, especially for Cu and Zn. It is concluded that the method provides a rapid and accurate method of determining metals in general foodstuffs. HSi

9 A 300

Fluorometric analysis. [A review]

White, C. E.

Analytical Chemistry 42 (5) 57R-76R (1970) [763 ref. En] [Univ., College Park, Maryland 20742, USA]

This detailed review is the 12th in a series of biennial reviews on fluorometric analysis and covers the period Dec. 1967 to Dec. 1969. A range of books is surveyed as well as research papers, and the field is considered under 3 headings: apparatus; inorganic (Al, Be, B, Ca, Mg, Li, Cd, Zn, Cu, Ag, Au, Ga, Tl, Fe, Co, Ni, Cr, Mn, etc.); and organic and biological (hydrocarbons and heterocycles, oxygenated molecules, amines, amino acids and proteins, enzymes, nucleotides, nucleic acids, immunofluorescence, steroids and hormones, pharmaceuticals, and agricultural chemicals and products). GLS

10 E 454

[Stabilized protein and method for its stabilization and pasteurization.] Stabilisiertes Eiweiss und Verfahren zum Stabilisieren und Pasteurisieren desselben.

Lineweaver, H.; Lineweaver, H.; Cunningham, F. E.
West German Patent Application 1 492 968 (1969) [De]

Method is described by which protein can be pasteurized by heat without coagulation occurring, and after pasteurization, the protein can be further processed, e.g. frozen, concentrated, dried, etc. pH of the protein is substantially adjusted to <9, but not <6.5, and sufficient metallic salt (Al, Fe, Cu, Ni, Mn, Co, Zn or Cd) is incorporated to stabilize the protein against coagulation on heating for 3-4 min at temp. 60°C. W&Co

VOLUME 3

1 A 11

[Determination of cadmium intake via food.]

Beiträge zur Bestimmung der Cadmiumzufuhr durch Lebensmittel.

Rautu, R.; Sporn, A.

Nahrung 14 (1) 25-31 (1970) [10 ref. De, ru, en] [Inst. für Hygiene, Bucharest, Roumania]

The Cd content of 14 foods of animal and 16 of vegetable origin were determined. The results of 10 analyses of each food served to establish the mean and max. contents in each product. In Roumania, mean dietary intake of Cd was 38-63 µg, and max. (from one meal) 103-176 µg. A tolerance limit of 50 µg/kg is recommended for the Cd content of food, except for beef, fish preserves with tomato puree and preserved tomato puree, for which a tolerance of 100 µg/kg is acceptable and for kidneys and kidney preserves, for which a tolerance limit of 500 µg/kg is proposed. IN

2 A 65

Determination of cadmium in total diet samples by anodic stripping voltammetry.

Hundley, H. K.; Warren, E. C.

Journal of the Association of Official Analytical Chemists 53 (4) 705-09 (1970) [4 ref. En] [FDA, 1009 Cherry St., Kansas City, Missouri 64106, USA]

Anodic stripping analysis was investigated for the determination of Cd in food samples and was found to be as reliable as atomic absorption for the determinative step. A hanging Hg drop is utilized to form an amalgam during controlled potential reduction. The amalgam is then stripped from the electrode by controlled electrolysis with a linearly varying potential. The recorded current measured during the stripping step was a direct linear function of the bulk concn. of Cd. The min. sensitivity, 0.01 ppm or 0.03 µg/ml in the final solution, is limited by the reagent blank. AS

A 93
 cadmium content in some foodstuffs in respect of its biological effects.
 Cener, J.; Bibr, B.
Erkrankung - Zivilisationskrankheiten 15 (4) 139-141 (1970) [9 ref. En, de, fr] [Inst. of Hygiene, Kobárova 48, Prague 10, Czechoslovakia]
 Colorimetric methods, substoichiometric isotope dilution analysis and atomic absorption spectrophotometry were used to determine traces of Cd in foodstuffs. Cd contents increased in the order: full fat milk (0.01 µg/g), meat, sugar, rice, onion, celery, garlic, parsley, carrots, potatoes, eggs, calf, pork, and beef liver and kidney (1.59 µg/g). In animal experiments, rats given 5 ppm Cd in drinking water gained less weight and consumed more food and water than controls. Most of the Cd accumulated in liver, kidneys and spleen. No elevation of blood pressure was found in experimental animals. RM

C 145
 The UK has established a nationwide system to check heavy metal fouling of foodstuffs.
 non.
Chemical and Engineering News 49 (4) 21 (1971) [en]
 Government laboratories are to test 3000 foodstuffs for methylmercury. The tests may be expanded to cover other metals such as Sb, Cu, and Cd. Reports are to be published twice yearly by the Ministry of Agriculture. JN

I 875
 Nutrient composition of selected wheats and wheat products. vi. Distribution of manganese, copper, nickel, zinc, magnesium, lead, tin, cadmium, cobalt, and selenium as determined by atomic absorption spectroscopy and colorimetry.
 Bok, E. G.; Greene, F. E.; Morris, E. R.
Anal. Chem. 47 (6) 720-31 (1970) [8 ref. En]
 Mg, Mn, Cu, Ni, Zn, Pb, Cd, Cr and Sn were determined in wheats, wheat blends, flours and wheat products. There was significant variation among hard wheats in contents of Ni, Zn, Pb, Sn, Cd and Cr. Concns. of all elements but Pb were lower in Baker's patent flour than in hard wheat. Flour was the major source of Mn, Cu, Zn, Mg and Pb in bread, but only ≤50% of Cr, Ni, Sn and Cd could be attributed to flour. Mn, Cu, Zn, Cd and Cr varied significantly in soft wheat. Highly refined short patent flours were generally lower in minerals than straight-grade and cut-off flours from soft wheat. Concns. of Mn, Cu, Zn, Mg were about the same or lower and Ni, Sn, Cd and Cr higher in cake and crackers than in the flour from which they are made. ~20-30% of durum wheat minerals were recovered in semolinas separated from it. Mineral content of macaroni was most entirely accounted for by semolina. There

was little difference between mineral content of bread prepared by conventional sponge-dough and continuous-mix procedures. Air classification vs. conventional milling had no significant effect on flour mineral content. There were significant variations in Pb, Cd and Cr concn. in most samples of consumer products, but geographic location had no discernible effect on the general mineral content of the products. Whole-wheat products contained greater concn. of Mn, Cu, Zn, Mg and Cr than products made from white flour. Se content of wheat blends and products was determined. Se concn. of hard wheat exhibited ~2-fold variation, but little variation was found in Se content of bread. JA

8 R 359
 [Biological value of carp meat].
 Adamova, I.; Svabova, M.; Wolf, A.
Vyziva Lidu 26 (2) 28-29 (1971) [Cs] [Lekarska Fak. Hygienicka UK, Prague, Czechoslovakia]
 Because of consumer preference for larger carp, meat qualities of (i) 2-yr old and (ii) 3-yr old carp were compared. Composition (g/100 g meat) of (i) and (ii) respectively was: water, 79.4 and 76.9; protein, 17.9 and 18.3; fat, 1.4 and 3. Mineral content (mg/100 g meat) was: Ca, 23.3 and 19.5; P 254 and 252; Fe, 0.43 and 0.57; Zn, 1.23 and 0.68; Cu 0.085 and 0.154; Cd, 0.014 and 0.020. (i) and (ii) did not differ significantly in meat yield or in organoleptic quality of raw or cooked meat. It is concluded that (i) and (ii) are equal in food value. SKK

9 H 1266
 [Determination of iron, copper, zinc, manganese and cadmium in grape must and wine by atomic absorption spectrophotometry.] Zur Bestimmung von Eisen, Kupfer, Zink, Mangan und Cadmium in Traubenmost und Wein mit Hilfe der Atomabsorptionsspektrophotometrie.
 Bergner, K. G.; Lang, B.
Deutsche Lebensmittel-Rundschau 67 (4) 121-24 (1971) [8 ref. De, en, fr] [Inst. für Lebensmittelchemie, Univ., Stuttgart, W. Germany]
 Zn, Mn and Cu (the latter in grape must only) were determined directly from the solution of ashed sample. To achieve adequate concn., Cu was extracted with methyl isobutyl ketone and Cd with methyl pentyl ketone as pyrrolidine dithiocarbamate. Fe was separated from interfering ions by extraction with n-amyl alcohol as PANate prior to atomic absorption spectrophotometry; well reproducible readings were obtained. OA

10 H 1538
 [Measurement of traces of Cd, Co, Cu, Fe, Mn, Pb and Zn in a few Belgian mineral waters by differential oscillopolarography at an imposed voltage].
 Es Souabni, A.; Nangniot, P.
Chimie Analytique 53 (3) 176-182 (1971) [25 ref. Fr, en] [Fac. des Sci. Agronomiques, Lab. de

Chimie Analyt., Gembloux, Belgium]

An oscillographic method for determining Cd, Co, Cu, Fe, Mn, Pb and Zn content in mineral water is described. The method is rapid and sensitive for concn. of $\geq 10^{-7}$ M. 11 mineral waters from Spa, Chevron, Spontin and Chaudfontaine contained/l.: 2.0-111.0 μ g Cu, 0.4-1.8 μ g Cd, 6.1-35.2 μ g Pb, 5.4-220.3 μ g Zn, 0.01-7.9 μ g Co, <0.08 -2370.9 μ g Mn and 23.2-14 256.9 or <100 -18 960 μ g Fe (depending on preparation method). RM

10 M 1144

[Determination of Cd in rice and soil by means of atomic absorption spectroscopy using an APDC-chloroform extraction system.]

Nagata, T.; Shimura, H.; Terashima, T. Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 11 (1) 41-45 (1970) [7 ref. Ja, en] [Nat. Inst. of Hygienic Sci. 6, Hoenzaka-cho, Higashi-ku, Osaka, Japan]

Determination of Cd in rice and soil by means of atomic absorption spectroscopy was examined using an ammonium pyrrolidinedithiocarbamate (APDC)-chloroform extraction system. APDC-chelate of Cd was extracted from the sample solution into chloroform, followed by direct spraying into an air-H flame and examination by atomic absorption spectroscopy. The flame was quite stable and the background vanishingly small at 228.8 nm (resonance line of Cd). The proposed method of determination had little interference from other metals, because of the excellent solubility of APDC-chelate in chloroform. This method has proved to be simple, convenient and accurate for determination of Cd in rice and soil. TM

10 M 1145

[Determination of Cd in rice by atomic absorption spectrophotometry with pretreatment by low temperature asher.]

Tanaka, R.; Yada, M.; Kobayashi, T. Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 11 (2) 84-87 (1970) [7 ref. Ja, en] [Osaka Prefectural Inst. of Public Health, 1-76, Minami, Mori-machi, Higashinari-ku, Osaka, Japan]

Rice was reduced to ash at low temp. and the ash subjected to atomic absorption spectrophotometry. Unlike conventional ashing, low temp. ashing allows almost complete retention of Cd with no volatilization. The recovery of Cd added to polished rice was 97.2%. TM

10 U 756

[Modern analytical methods.] Über moderne Analysen-Methoden.

Anon.

Allgemeine Fischwirtschaftszeitung 23 (9) 24 (1971) [De]

A report is given of the 6th Conference of the FAO/WHO Codex Committee on analytical methods held in Bonn-Bad Godesberg in Jan. 1971, to evaluate international reference methods for all

foods, additives and foreign matter. This included fats, oils, mushroom, fruit, vegetables, deep-frozen products, honey, chocolate, fruit juices, dietary foods, preservatives, antioxidants, colouring substances and metallic contaminants. Methods of estimation of CO₂, sorbic acid, benzoic acid, PHB-ester, formic acid, hexamethylenetetramine, salicylic acid and boric acid, Hg, Pb, As, Cd, Cu, and Zn were discussed. OA

12 P 2061

Cadmium, copper, iron, lead, manganese, and zinc in evaporated milk, infant products, and human milk.

Murthy, G. K.; Rhea, U. S.

Journal of Dairy Science 54 (7) 1001-1005 (1971) [25 ref. En] [Dept. of Health, Education and Welfare, FDA, Cincinnati, Ohio 45226, USA]

Trace minerals were measured by atomic absorption spectrometry in market samples of 4 brands of evaporated milk and 2 modified milk-, 1 soya flour- and 1 lamb meat-based formulae, and in samples of human milk from 13 mothers. Average levels of the various elements in market samples and human milk respectively were as follows (ppm): Cd, 0.020-0.042 and 0.019; Cu, 0.09-1.49 and 0.24; Fe, 0.82-19.01 and 0.84; Pb, 0.33-0.87 and 0.012; Mn, 0.18-2.68 and 0.12; and Zn, 2.95-8.60 and 1.34. Evaporated milk contained the most Pb, whereas formulae based on soya flour or lamb meat were highest in the other trace elements. Dextrimaltose contributed insignificant amounts of trace elements to a formula prepared from evaporated milk. Results are discussed in relation to trace element requirements of infants. CDA

VOLUME 4

2 C 33

Embryotoxicity of chemical contaminants of foods. [A review]

Clegg, D. J.

Food and Cosmetics Toxicology 9 (2) 195-205 (1971) [59 ref. En] [Food Advisory Bureau, Food and Drug Directorate, Carlingwood Plaza, Carling Avenue, Ottawa, Ontario, Canada]

A brief review is given of some contaminants that may occur in foodstuffs: mycotoxins (aflatoxins), metals (Zn, Cd, Ca, Se, Pb, Hg, ⁹⁰Sr), nitrosamines, pesticides (2,4,5-T) and polychlorinated biphenyls. It indicates that in the majority of cases embryotoxicity or teratogenicity are toxic hazards unlikely to occur in practice as a result of such contamination. The possible exception is Hg and in particular methylmercury. VJG

2 C 40

Source and occurrence of environmental contaminants. [A review]

Somers, E., Smith, D. M.

Food and Cosmetics Toxicology 9 (2) 185-193 (1971)

[47 ref. En] [Food and Drug Directorate, Lunney's Pasture, Ottawa 3, Ontario, Canada]

Sources and occurrence of the following food contaminants: trace elements (Pb, Cd, Hg and As); pesticides; polychlorinated biphenyls; and chlorodioxins, are reviewed. VJG

2 R 63

Report of a survey of fish products for metallic contamination undertaken in South West England and South Wales during early 1971.

Taylor, D. J.

Journal of the Association of Public Analysts 9

(3) 76-85 (1971) [2 ref. En] [Scientific Adviser's Dept., Canynge Hall, Bristol, BSS 2PR, UK]

This synopsis of a paper read at the Annual General Meeting of the Association of Public Analysts at Matlock, May 1971, reports work carried out by 8 Public Analysts' Laboratories in the South West in a collaborative study of metallic contamination of fish products. 209 fish products (including 48 samples of tuna fish) were examined for Hg, methyl mercury, As, Cd, Cu, Zn and Pb. The following ranges were obtained (ppm): Hg, 0.1-0.9; As, <0.5-20; Cd, 0-6; Cu, 0-50; Zn, 0-50; Pb, 0-5. Tuna fish levels (ppm) were: Hg, 0.1-0.8, mean level 0.3; As, <0.5; Cd, <0.2; Cu, <3; Zn, <20; Pb, <1.3. Most of the Hg was in the form of methyl mercury compounds. VJG

3 A 149

Determination of traces of cadmium in biological materials by atomic absorption spectrophotometry. Lener, J.; Bibr, B.

Journal of Agricultural and Food Chemistry 19 (5) 1011-1013 (1971) [6 ref. En] [Inst. of Physiol., Budejovicka 1083, Prague 4, Czechoslovakia]

The Cd content of food was determined by atomic absorption spectrometry with air/acetylene and air/propane heating mixtures, using 2 methods of preparation: (i) directly after acid mineralization and (ii) after extraction of Cd, following mineralization, using dithizone in chloroform. There was no statistical difference between the methods. The direct method was reproducible for Cd concn. >0.06 ppm, using the air/acetylene system, with no interference from the mineral acids used in the preparation procedure. The Cd content of foods, using the direct method, was found to be ($\mu\text{g/g} \pm \text{SEM}$): celery, 0.058 ± 0.013 ; parsley, 0.088 ± 0.077 ; garlic, 0.077 ± 0.001 ; carrot, 0.086 ± 0.024 ; onion, 0.047 ± 0.003 ; potatoes, 0.092 ± 0.002 ; milk, 0.010 ± 0.003 ; egg yolk, 0.120 ± 0.005 ; egg white, 0.076 ± 0.004 . SAC

3 S 317

[Residues in meat, their occurrence, significance and determination within the framework of official

meat inspection.] Rückstände im Fleisch, Vorkommen und Bedeutung sowie ihre Beurteilung im Rahmen der amtlichen Fleischuntersuchung.

Grossklau, D.

Bundesgesundheitsblatt 14 (15/16) 205-211 (1971)

[12 ref. De]

This review-type article covers the following aspects of sources and types of residues in foods: drug residues in meat (antibiotics, chemotherapeutic agents, antiparasite compounds, sedatives, fattening agents, glucocorticosteroids); residues of additives used for animal nutrition; pesticide residues; residues arising from toxic compounds in the environment e.g. radioactive contamination, Pb, Hg, Cd, polychlorinated biphenyls; establishment of tolerance levels for residues; and meat examination from a legal point of view. JA

4 R 156

Preliminary survey of heavy metal contamination of Canadian freshwater fish.

Uthe, J. F.; Bligh, E. G.

Journal of the Fisheries Research Board of Canada 28 (5) 786-788 (1971) [8 ref. En] [Fisheries Res. Board, Freshwater Inst., Winnipeg 19, Manitoba, Canada]

The concn. of Pb, Ni, As, Cu, Sb, Cd, Zn, U, Hg, Mn, Se, Cr and Sn in lake whitefish (i) and northern pike (ii) from Moose Lake, in (i) from Lake Ontario, in (ii) from Lake St. Pierre and Lake Erie, and in rainbow smelt and yellow perch from Lake Erie are given. With the exception of Hg, the levels were within regulatory limits and did not differ significantly between industrial and non-industrial areas. JN

5 C 128

Mercury in food.

Anon.

British Food Journal 74 (846) 5 & 8 (1972) [En]

2 recent surveys of Hg contamination of food are discussed. Mean levels were 0.19 ppm in canned tuna fish, 0.08 ppm in canned salmon, 0.07 ppm in fresh and canned shellfish and crustaceans, 0.06 ppm in other canned fish and 0.06 ppm in fresh white fish. Levels in small samples of other foods were generally low, but showed a wide range. Tuna fish was seen to be the only product appreciably contaminated, ~80% of the Hg being in the form of methyl mercury compounds. Arsenical contamination of fish ranged from 0.5 to 20 ppm, the majority containing <1.2 ppm; cadmium contamination was in the range 0-6 ppm with levels generally <1.2 ppm; copper 0-50 ppm; zinc 0-50 ppm; and lead 0-5 ppm. Levels of heavy metals in tuna fish apart from Hg were low. PG

5 R 241

Effects of transition metal ions on the extractable protein of fish muscles.

Castell, C. H.; Smith, B.; Neal, W.

Journal of the Fisheries Research Board of Canada

27 (4) 701-714 (1970) [17 ref. En] [Fisheries Res. Board, Halifax Lab., Halifax, Nova Scotia, Canada]

Addition of 10-50 ppm of several transition metal ions rapidly decreased the extractable protein content of blended fish muscle. The most active metals were Cu^{++} and Cr^{++} followed by Sn^{++} and Cd^{++} . Other ions tested, Ce^{++} , Zn^{++} , Ni^{++} , Co^{++} , Fe^{++} , Fe^{+++} , V^{++} , and Mn^{++} , brought about relatively little or no change in extractable protein nitrogen (EPN) values. Effects of the metals differed with muscle from different species. Lean fish were more susceptible than either fatty fish or shellfish. Of all the species tested the metals had the least effect on scallops. A limited number of tests indicated that fish that were badly emaciated through starvation were more susceptible to the metal-induced change than normal individuals of the species. Addition of certain amino acids; notably cysteine, histidine, glutamic acid, and tryptophan, protected the muscle against metal-induced reduction of EPN. With lean fish, the amino acids that protected the muscle against metal-induced change in the proteins also protected it against metal-induced oxidation of the lipids; with fatty fish, protection against rancidity was somewhat less; the invertebrates seemed to be normally protected against both without the addition of amino acids. The natural immunity of marine invertebrate muscle to changes induced by the addition of heavy metal ions may in part be attributed to their normally high content of free amino acids. AS

5 R 246

Concentrations of trace elements in Great Lakes fishes.

Lucas, H. F., Jr.; Edgington, D. N.; Colby, P. J. *Journal of the Fisheries Research Board of Canada* 27 (4) 677-684 (1970) [12 ref. En] [Radiological Physics Div., Nat. Lab., Argonne, Illinois 60439, USA]

Concn. of 15 trace elements was determined by activation analysis of samples of whole fish (alewives, spottail shiners and trout-perch) and fish livers from 3 of the Great Lakes: Michigan, Superior and Erie. Average concn. of 7 elements in 19 whole fish from the species were as follows: U, 3 ppb (parts per billion); Th, 6 ppb; Co, 28 ppb; Cd, 94 ppb; As, 16 ppb; Cr, 1 ppm; and Cu, 1.3 ppm. Average concn. of 8 elements in 40 liver samples from 10 spp. of fish were as follows: U, ~2 ppb; Th, ≤2 ppb; Co, 40 ppb; Cu, 9 ppm; Zn, 30 ppm; Br, 0.4 ppm; As, 30 ppb; and Cd, 0.4 ppm. Other elements observed in most of the samples were: Sb, 5-100 ppb; Au, 2-5 ppb; La, 1-20 ppb; Re, 0.5-5 ppb; Rb, 0.06-4 ppm; and Se, 0.1-2 ppb. Trace element concn. varied with species and lake. U and Th varied with species, but not for the same species from different lakes. The levels of Cu, Co, Zn and Br varied little between species and lakes. Concn. of Cd, As, and Cr varied little between species and with species between lakes. AS

6 C 150

[Studies on microelements in food products in areas of endemic nephropathy in Bulgaria.]

Stephanov, J.; Yaneva, S.; Mladenova, S. *Sbornik Trudove Nauchnoissledovatel'skiya Khigieny Institut* 12: 56-68 (1970, publ. 1971) [93 ref. Bg, en] [Min. of Nat. Health, Res. Inst. of Hygiene, Sofia, Bulgaria]

Fresh wheat, maize, potatoes, beans, and milk were analysed for Cr, Cd, Ni and Sn by spectrographic methods, for Pb by the dithizone method, and for Se by colorimetry using 3,3-diamino-benzidine-HCl, in endemic nephropathy and control areas in Bulgaria. Concn. levels in mg/kg are extensively tabulated and related to the 2 communities. It is concluded that the increased concn. of these trace elements in body organs, reported by other authors, is not essentially synonymous with their intake through food. In particular, naturally occurring levels of Cd in corn, potatoes, and beans are not considered to exert a toxicological effect per se, and a possible complex in vivo biochemical interaction is suggested. QA

6 C 151

[Studies on the cadmium content in food products.]

Naidenov, A. *Sbornik Trudove Nauchnoissledovatel'skiya Khigieny Institut* 12: 109-112 (1970, publ. 1971) [15 ref. Bg, en] [Min. of Nat. Health, Res. Inst. of Hygiene, Sofia, Bulgaria]

Cd content was determined by the dithizone method in wheat, sweet corn, beans, potatoes, carrots, tomatoes, apples and green peppers from 5 Bulgarian regions. Min., max., and mean average values in mg/kg are tabulated and suggested as a base line for permissible Cd levels in Bulgarian foods. The subject is briefly reviewed with particular reference to the work of Roumanian authors and the incidence of nephropathy. OA

8 A 370

[Method for wet-ashing biological materials.]

Verfahren zum Aufschluss und/oder zur Nassveraschung von organischem Material, insbesondere von biologischen Substanzen. Sansoni, B.; Kracke, W. (Gesellschaft für Strahlenforschung mbH) *West German Patent Application* 1 773 750 (1971) [De]

Prior to analysis for inorganic components, e.g. traces of Fe, Pb, Hg, Cd, As, Zn, or for radionuclides e.g. ^{137}Cs , ^{22}Na or ^{106}Ru , organic material, e.g. meat, fish, milk, flour, vegetables, bones or sugar, is ground and heated with H_2O_2 solution. A trace of ferrous salt is added, and after the spontaneous main reaction has taken place, the material is dried by evaporation. More H_2O_2 is added and evaporation repeated until a purely inorganic ash, contaminated only by the Fe added and ammonium salts, is left. For a more rapid method, H_2O_2 is added only once; in both cases unwanted fat is removed by extraction or separation with suitable organic solvents. W&Co

8 C 197

[Results of chemical tests relating to preservation of the environment.] Ergebnisse chemischer Untersuchungen zum Umweltschutz.

Barchet, R.; Biermann, J.; Feucht, M.; Haag, Th.; Jori, H.; Wilk, G.

Deutsche Lebensmittel-Rundschau 68 (3) 69-74 (1972) [15 ref. De] [Chem. Untersuchungsamt, 7 Stuttgart 1, Stafflenbergstrasse 81, German Federal Republic]

Results of examinations of food in Stuttgart for residues of Sn, Hg, Pb, Cd, Be, and DDT are discussed, together with the most commonly used methods of analysis and existing information on toxic levels. Occurrence of Sn in foods reached the legal permitted max. level in the German Federal Republic of 250 mg/kg in very few samples; the majority contained <50 mg/kg. Recent work on the occurrence of Hg in fish, mainly in Japan and the USA, is reviewed. The occurrence of Pb on plant surfaces, especially near motorways, is mentioned, together with examination of a wide variety of fruits and vegetables exposed in a busy street in Stuttgart and from private gardens; this work indicated ubiquitous distribution of Pb. Blood Pb levels which result in illness are discussed, together with industrial sources, e.g. lead-processing factories, battery factories, car industry. Contents of Cd (used in anticorrosion processes) found in samples of urine were well below toxic levels. Be (used in various alloys) was also below toxic levels in urine samples, which in 1970 were all Be-free. Data are given for the incidence of DDT residues in various parts of the German Federal Republic and compared with published figures for other countries. ELC

9 H 1318

[Methods of removing metals from must and wine.] Methoden zur Entfernung der Metalle in Most und Wein. [A lecture]

Würdig, G.

Allgemeine Deutsche Weinfachzeitung 108 (11) 267-270 (1972) [De] [Weinforschungsinst., Landeslehr- & Versuchsanstalt für Weinbau, Gartenbau und Landwirtschaft, Trier, German Federal Republic]

Max. permissible contents of trace elements in wine as established by the Office International du Vin and the latest W. German wine regulations are (mg/l.): Al 8, As 0.2, Pb 0.4, B (as boric acid) 80, Br (total) 1, F 5, Cd 0.1, Cu 5, Zn 6, Sn 1 and Ag 0.1. Tests have shown that even in areas of high contamination, these concn. are not reached. Methods of eliminating trace metals in the unlikely event of excess concn. in must and wine are described. TUB-IGB

10 A 433

[Amperometric titration of calcium, magnesium and cadmium with two polarizable platinum electrodes and its application to foods.]

Hashinaga, F.; Nagayoshi, M.; Osajima, Y.; Furutani, S.

Journal of the Agricultural Chemical Society of Japan [Nihon Nogei Kagakkai-shi] 45 (11) 494-499 (1971) [18 ref. Ja, en] [Dept. of Food Sci. & Tech., Fac. of Agric., Kyushu Univ., Fukuoka, Japan]

Quantitative determinations of Ca^{2+} , Mg^{2+} and Cd^{2+} were carried out, using 2 polarizable Pt electrodes at 0.8 V constant applied voltage, in 0.1M ammonia/ NH_4Cl (pH 11) solution containing 1M triethanolamine, which was found to give sharp, uniform titration curves on titrating with 0.01M EDTA, giving relative errors of 0.5, 0.2 and 1.0%, respectively, for the metal ions. The masking agent 2,3-dimercapto-propanol eliminated interference due to Ag, Al, As, Cd, Co, Cu, Fe, Hg, In, Ni, Pb and Zn, so that selective titration for Ca^{2+} , Mg^{2+} and Cd^{2+} was performed at pH 11.0 and 12.5, using this masking agent for Cd. In foods, Ca^{2+} and Mg^{2+} were measured after removing phosphoric acid with potassium metastannate. [From En summ.] SAC

10 H 1551

[Cadmium content of German wines.] Zum Cadmiumgehalt deutscher Weine.

Bergner, K. G.; Lang, B.; Ackermann, H.

Mitteilungen: Rebe, Wein, Obstbau und Früchteverwertung 22 (2) 101-105 (1972) [15 ref. De, en, fr, es] [Inst. für Lebensmittelchem., Univ., Stuttgart, German Federal Republic]

24 German wines from different varieties of vine and from different vine-growing regions were tested by atomic absorption spectrophotometry and found to contain between 0.5 and 8 µg/l. of Cd (mean value 2.9 µg/l.). No dependence on variety or region was detected. Fermentation of 7 grape musts produced wines with a Cd content of only 10-50% of that of the must; on average, the Cd content of the wines tested was only 35% of that of the musts. Higher Cd values of 22-71 µg/l. were found in wines of 2 types. Test results arrived at over a number of yr seem to suggest that Cd contamination occurred once only and disappeared again completely by the 3rd yr. Musts and wines produced from wines treated with garbage compost display higher Cd figures, which means that the Cd content can also be increased as a result of the fertilizer used. The Cd values of all 36 samples tested were below the max. figures: 0.1 mg/l. for juice and 0.5 mg/l. for wines, suggested in previous literature on the subject. AS

11 C 260

Mercury and heavy metals in food. II.

Anon.

British Food Journal 74 (847) 37-38 & 44 (1972) [En]

This is a review of a report of a working party addressed to the Food Additives and Contaminants Committee. Particular attention was given to

methyl mercury compounds with reference to ingestion and accumulation of Hg in the tissues, and the effect on health. 4000 food samples (wheat flour, beef, beef liver, chicken, eggs, milk, dried milk, cheese, green vegetables, fish, shellfish, apples, tomatoes (both canned and fresh), rice, sugar, potatoes, fish liver oil, carrots, bacon, ham, pig kidney and liver) from 18 main towns in the UK were examined by atomic absorption spectrophotometry, colorimetry, and GLC for total Hg (organic and inorganic). All levels found were low (≤ 0.005 mg/kg), except in fish (0.03-0.20 mg/kg); in canned fish mean average values were 0.01-0.04 mg/kg. The results are compared with those given in a report by the Association of Public Analysts [FSTA (1972) 4 5C128] and good correlation is found. The daily Hg intake through food in the UK is estimated at <10 μ g/person; this partly reflects the low consumption of fish in the UK. Continued monitoring of Hg contamination, as well as contamination with Pb, Cd, and other heavy metals is recommended. OA

12 T 681

Measures trace metals in volatile flavourings.

Eiserle, R. J.

Food Engineering 44 (5) 86-87 (1972) [En]
[Fritzsche-D&O, New York City, USA]

A non-flame atomic absorption instrument for the determination of heavy metals (especially Pb, As, Fe, Cu and Cd) in volatile flavouring agents is briefly described. The apparatus employs a carbon rod work head, heated electrically to dry, ash and atomize samples syringed into an orifice in the rod. Exact determination in the parts/million range may be made. WHCA

12 R 687

[Mercury content of fish.] Quecksilbergehalt von Fischen.

Anon.

Allgemeine Fischwirtschaftszeitung 24 (15) 28 (1972) [De]

The presence of Hg, Cd, Cu, As, Fe and DDT in different varieties of fish of wide geographical distribution are discussed, and their effects on human consumption and environment are summarized. OA

12 R 716

Cadmium in crabs and crabmeat.

Reynolds, C. V.; Reynolds, E. B.

Journal of the Association of Public Analysts 9 (4) 112-115 (1971) [2 ref. En] [Tickle & Reynolds, Public Analyst's Lab., 1 Barnfield Crescent, Exeter, Devon, UK]

The proportion of Cd in crabs (*Cancer pagurus*) caught off the N. and S. Devon coast and in other crabmeat and crabmeat products was investigated. 20 g portions of the comminuted products were digested with mixed nitric and sulphuric acids, and Cd determined using the official method. The following results were obtained for range of Cd content (ppm) with number of samples in parentheses: crab pastes (preliminary samples), 0.4-9.0 (7); canned crabmeat, claw meat and other white meat, 0.05-0.15 (6); raw crabmeat, claw meat and other white meat, 0.02-1.1 (2); raw crabmeat, dark body meat and mixed meats, 2.5-8.6 (6); whole crabs, cocks, edible portion, 0.17-8.4 (9); whole crabs, hens, edible portion, 2.1-9.7 (20); dressed crabmeat canned, 1.0-5.2 (6); dressed crabmeat raw, 3.9-10.0 (3); and crab pastes and spread, 0.37-4.0 (5). It is concluded that Cd is generally present in the dark body meat of crabs but not in the claw and other white meat. VJG

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VOLUME 5

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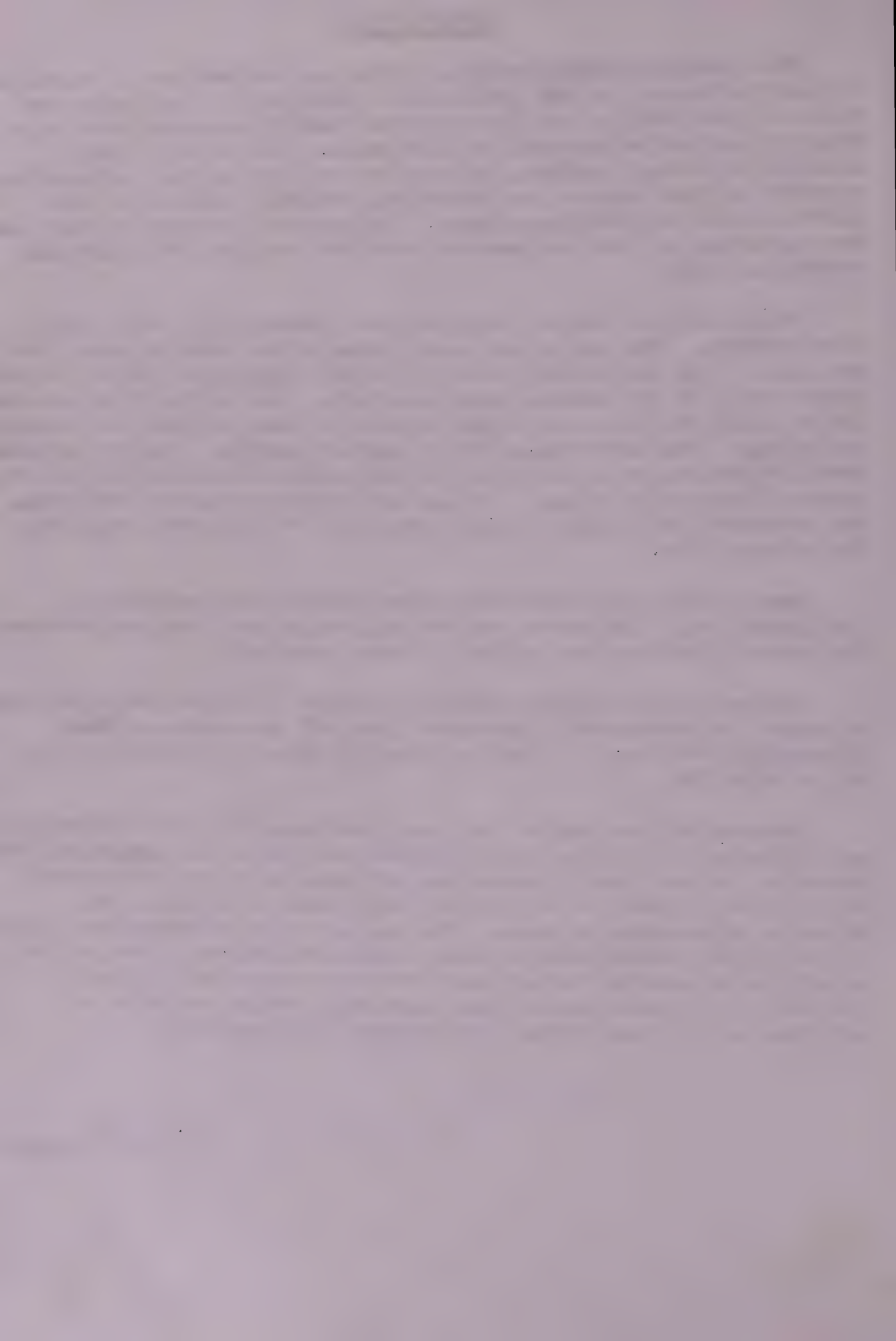
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J. NE TON
ASSISTANT EDITOR



2 A 127

Advanced analytical instrumentation.

Leslie, R. C.

Food Manufacture 47 (11) 41, 43, 46 (1972)
[En] [Perkin-Elmer Ltd., Beaconsfield, Bucks, UK]

The various analytical instruments and techniques described are classified into 2 categories; (i) those which separate mixtures and (ii) those which identify single components or measure some physical property which can be related to chemical or physical structure. Included in (i) are: the use of gas-liquid and liquid-solid chromatography for the analysis of complex mixtures, e.g. essential oils and meat flavours; TLC for the separation and identification of pesticide residues in cereals, vegetables and fruit; analysis of halogen-containing residues using the electron capture detector; and liquid chromatography for the separation of lipids, antioxidants, oligosaccharides, food colours and for the resolution of aflatoxins B₁ and G₁. In (ii) details are given of: spectrophotometry; UV and visible absorption spectroscopy and their use for the quantitative determination of artificial colourings and assay of antioxidants, preservatives, additives, and pesticides present in foodstuffs; atomic absorption and its use in the determination of toxic elements such as As, Pb, Cd, Co, Zn, Sn and Hg in foodstuffs; the application of IR analysis to the identification of organic substances e.g. characterization of essential oils, determination of BHT in fats and the identification of preservatives extracted from meat; emission spectroscopy for quantitative analysis and simultaneous determination of several elements e.g. Na, K; fluorescence emission measurements for the determination of thiamine, riboflavin, other vitamins, lecithin, aromatic amines and carbohydrates; and elemental and thermal analysis.

AA

2 H 255

Mercury and cadmium determination in water by prompt (n, γ) method - ²⁵²Cf as the neutron source.
Handley, T. H.; DeCarlo, V. A.

Journal of Radioanalytical Chemistry 11 (2) 265-271 (1972) [6 ref. En] [Analytical Chem. Div., Oak Ridge Nat. Lab., Tennessee, USA]

An evaluation of the sensitivity of Hg and Cd determinations in a large vol. of water is presented. A 10- μ g ²⁵²Cf source immersed in the water sample served as a neutron source. The (n, γ) reaction on Hg and the inelastic scattering from oxygen produced a background count rate that limited sensitivity. A lower limit of 20 ppm for both Hg and Cd was found. The procedures described can be applied to most of the other heavy metals.

AS

2 L 127

Determination of trace amounts of metals in foodstuffs by atomic absorption spectroscopy.
Nelson, G.; Smith, D. L.

Proceedings of the Society for Analytical Chemistry 9 (8) 168 (1972) [1 ref. En] [Rowntree Mackintosh Ltd., Halifax, Yorks, UK]

An automated dry ashing technique was used for destruction of confectionery raw materials and finished products prior to determination of their Pb, Cu, Sn and Zn contents. Ashing in a temp. programmable electric muffle furnace, housing 40 crucibles (3 in diam.) to a max. temp. of 550°C, required min. supervision by an analyst and ashed 200 samples/working week. Ashes were extracted with boiling 50% HCl and analysed by atomic absorption spectrophotometry using an EEL 240 instrument in conjunction with an automatic sampler. Wet ashing using a mixture of H₂SO₄ and HNO₃ was used for destruction of confectionery material prior to determination of Cd and Hg contents by atomic absorption (Cd by conventional flame, Hg by cold vapour technique). Vegetable C could be distinguished from Channel Black by its

Sn content of 0.2-0.4% against none in Channel Black. Presence of metallic Fe >30 ppm in chocolate could lead to erroneous fat contents as measured by NMR spectroscopy. RM

2 T 53

Quantitative determination of cadmium in water-soluble colour additives by atomic absorption spectroscopy.

Moten, L.

Journal of the Association of Official Analytical Chemists 55 (5) 1145-1149 (1972) [4 ref. En]
[Div. of Colors and Cosmetics Tech., FDA, Washington, DC 20204, USA]

A quantitative method is presented for the determination of cadmium at low levels (5-20 ppm) in water-soluble colour additives by atomic absorption spectroscopy. Absorption measurements were made on aqueous solutions of typical colour additives to which known amounts of cadmium had been added. The method requires no pretreatment of sample and should be applicable to all water-soluble colour additives. AS

2 T 86

[Cadmium contents in calcium phosphates for food additives.]

Endo, F.; Hirokado, M.; Sakaino, K.; Tamura, M.; Yasuno, T.; Yamato, O.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 22, 101-103 (1970)
[7 ref. Ja, en] [Dept. of Food Additives, Tokyo Metropolitan Res. Lab. of Public Health, Japan]

Atomic absorption spectrophotometry was used for the determination of Cd in calcium phosphates intended for use as food additives. Contents of approx. 0.15 ppm Cd were detected. [From En summary] AA

3 J 365

Uptake of soil-applied cadmium and its distribution in radishes.

John, M. K.

Canadian Journal of Plant Science 52 (5) 715-719 (1972) [10 ref. En, fr] [Res. Sta., Canada Agric., Agassiz, British Columbia]

Various amounts of cadmium chloride were added to unlimed and limed Hjorth soil in a growth-chamber experiment to study cadmium uptake by radish plants. The plants accumulated more cadmium in the tops than in the root portion. Concentrations in both tops and roots increased progressively as more cadmium was added to the soil. When lime was also applied, plant concentrations were increased to a lesser degree than for unlimed soil. Both independent variables, included in equations to predict plant cadmium content from added cadmium and added lime contributed significantly to the multiple regression. AS

3 R 153

Cadmium uptake by marine organisms.

Eisler, R.; Zarogian, G. E.; Hennekey, R. J.

Journal of the Fisheries Research Board of Canada 29 (9) 1367-1369 (1972) [6 ref. En, fr] [US Environmental Protection Agency, Nat. Marine Water Quality Lab., W. Kingston, Rhode Island 02892, USA]

Adults of mummichog (*Fundulus heteroclitus*), scallop (*Aquiptecten irradians*), oyster (*Crassostrea virginica*) and subadult lobsters (*Homarus americanus*) were immersed for 21 days in flowing sea water containing 10 µg/l. of Cd as CdCl₂. 21/2 H₂O. Cd residues in whole animals and selected tissues were consistently higher in exposed organisms than controls; edible portions of treated lobster (muscle), scallop (adductor muscle), and oyster (whole animal) contained more Cd per unit wt. than controls by 25%, 19% and 35.2%, respectively. AS

3 R 175

The comparative metabolism of cadmium, mercury and zinc as environmental contaminants in the freshwater mussel, *Margaritifera margaritifera*.

Mellinger, P. J.

Dissertation Abstracts International, B 33 (4) 1601: Order no. 72-27637 (1972) [En] [Oregon St. Univ., Corvallis, 97331, USA]

The uptake, tissue distribution and retention patterns of Cd, Hg and Zn were examined in the freshwater mussel, *M. margaritifera*. Mussels were maintained in separate solutions containing radioisotopes of these metals at 14.5°C. The uptake was followed for 39-80 days of chronic exposure, at which time a near equilibrium was reached in most

experiments. At this point all animals were placed in uncontaminated water. The tissue distribution was remarkably constant over separate studies lasting from 67-150 days. % of whole body activity remaining after 81 days was 87% for methylmercuric chloride, 69% for mercuric nitrate, 76% for cadmium chloride and 57% for zinc oxide. Retention studies were terminated after approx. 81-150 days. Inhibition of Zn uptake in muscles was demonstrated when 2 ppm Cd was added to the experimental solution. AA

4 J 495

Lead and cadmium content of some vegetable foodstuffs.

Thomas, B.; Roughan, J. A.; Watters, E. D.

Journal of the Science of Food and Agriculture 23 (12) 1493-1498 (1972) [24 ref. En] [Min. of Agric., Fisheries and Food, Plant Pathology Lab., Hatching Green, Harpenden, Herts, UK]

An analytical method and results are given for the determination of lead and cadmium in Brussels sprouts, apples, pears, cabbages, potatoes, onions, leeks, carrots, swedes, watercress, frozen vegetables, cucumber, celery, tomatoes, mushrooms and dried herbs. The lead content of the 231 samples was in the range 0.01 to 3.85 ppm the mean being 0.05 ppm; the range and mean of the cadmium content were 0.01 to 0.22 and 0.04 ppm, respectively. AS

4 S 389

Pesticide and heavy metal residues.

Spaulding, J. E.

Proceedings of the Meat Industry Research Conference Mar., 11-23 (1972) [4 ref. En] [USDA, Washington, DC 20250, USA]

Pesticide and heavy metal residues in meat and poultry are discussed with special reference to chlorinated hydrocarbon insecticide residues in animals and poultry, and Hg, Pb and Cd levels in liver, muscle and kidney of cattle. The problem of polychlorinated biphenyl residues is also briefly considered. AA

5 B 55

[Metals in liquid smokes.]

Shiraishi, Y.; Kuzuhara, Y.; Sakagami, Y.

Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 12 (3) 216-219 (1971) [1 ref. Ja] [Dept. Public Health Pharmaceutics, Inst. of Public Health 6-1, Shirogane-dai 4-chome, Minato-ku, Tokyo, Japan]

Metals in 26 commercial liquid smokes for food processing were analysed by atomic absorption method. The data for Pb, Zn, Cu, Cd, Mn, Co and Ni are tabulated in English. TM

S R 216

Persistent chemicals in marine mammals.

Koeman, J. H.; Peters, W. H. M.; Smit, C. J.; Tjioe, P. S.; Coeij, J. J. M. de

TNO-Nieuws 27 (10) 570-578 (1972) [47 ref. En, nl] [Inst. of Vet. Pharmacology and Toxicology, Utrecht, The Netherlands]

Residue levels of various chlorinated hydrocarbons, including DDT, DDE, DDD, dieldrin, and polychlorinated biphenyls, and of metals such as Hg, Cd, As, Se and Zn, in the tissues of whales, seals and other marine mammals are reported. AA

7 A 321

[Studies on the atomic absorption spectroscopic determination of cadmium.]

Nakamuro, K.; Sayato, Y.; Tonomura, M.

Bulletin of the National Institute of Hygienic Sciences [Eisei Shikenjo Hokoku] 90, 38-43 (1972) [4 ref. Ja, en]

A convenient, quick and accurate procedure for determination of Cd in various material was developed. The material is combusted by the oxygen bomb combustion method instead of wet ashing and the Cd ion is determined by atomic absorption spectrophotometry after treatment with a DDTC-MIBK (sodium diethyl dithiocarbamate-methyl isobutyl ketone) system. This procedure showed linearity in the range 0.2-5.0 µg when assayed at a wavelength of 228.8 nm, and the sensitivity was 0.2 µg Cd in 10 ml MIBK solution. The recovery of Cd was about 100% by this method. The method was applied successfully to rice and fish. AS

8 A 357

[Paper chromatographic separation and quantitative determination of submicro-amounts of cadmium.] Papierchromatographische Trennung und quantitative Bestimmung von Submikromengen Cadmium.

Bönig, G.; Heigener, H.

Landwirtschaftliche Forschung 25 (4) 384-387 (1972) [27 ref. De, en, fr] [Landwirtschaftliche Untersuchungs- und Forschungsanstalt, Kiel, Federal Republic of Germany]

A method for the determination of trace amounts of cadmium in plants and soils is described. Cd is extracted in the presence of Cu, Co, Zn, Ni and Pb using dithizon in chloroform at a pH of 11 to 12. It is then separated from these elements by ring paper-chromatography using a mixture of n-butanol and 1 N HCl as eluent and determined colorimetrically in the excised ring with Cadion. MJD

8 T 388

Evaluation of certain food additives and of the contaminants mercury, lead and cadmium.

Sixteenth report of the Joint FAO/WHO expert committee on food additives.

Food & Agriculture Organization; World Health Organization

FAO Nutrition Meetings Report Series No. 51, 32pp. (1972) [En] [Rome, Italy]

This report deals with the evaluation of certain intentional additives (amaranth, caramel colours made by the ammonia process, diethyl pyrocarbonate and octyl gallate) and toxic metals (Hg, Pb and Cd) in foods. Aspects considered include methods of analysis, levels of toxic metals in food and the environment, principles of toxicological evaluation, comments on individual substances, establishment of control measures, and recommendations. 2 annexes give reports and other documents resulting from previous meetings of the FAO-WHO Expert Committee on Food Additives, and tolerable and acceptable daily and weekly intake levels for the additives and metals studied. AJDW

10 C 271

Monitoring for heavy metals.

Tolan, A.

Nutrition and Food Science No. 30, 13-15 (1973) [6 ref. En]

Most heavy metals present no problem from the point of view of food contamination; only Pb, Hg and Cd are of real interest. In the UK a survey monitored amounts present in individual foods, determined whether any food might present special problems, and checked food from areas which might be affected by local contamination of the environment. Results showed amounts of Hg to be generally <0.005 mg/kg (with the exception of fish, 0.06-0.07 mg/kg, and shellfish). Total Hg concn. in the average diet was estimated at 0.0065 mg/kg. Mean Pb concn. in the diet was estimated at not more than 0.13 mg/kg, so that total daily amount consumed was approx. 200 µg. Mean Pb content of foods ranged from 0.24 mg/kg for green vegetables to 0.03 mg/kg for milk. Cd content of food is currently being monitored. PG

11 C 308

Collaborative study of an atomic absorption method for the determination of lead and cadmium extracted from glazed ceramic surfaces.

Krintitz, B.; Franco, V.

Journal of the Association of Official Analytical Chemists 56 (4) 869-875 (1973) [13 ref. En] [FDA, 850 Third Ave., Brooklyn, New York 11232, USA]

A method for the determination of Pb extracted from glazed ceramic surfaces (e.g. eating, cooking, drinking and measuring vessels) was adapted from

German standard procedure and extended to include extractable Cd. Studies comparing a 0.5 h exposure to 4% acetic acid at room temp. ($22 \pm 2^\circ\text{C}$) with a 24 h exposure under the same conditions indicated that the longer exposure gave higher, asymptotic values for extracted metal. In the collaborative study, 7 samples of the 24 h leach solution containing Pb, one of these also containing Cd, were sent to 13 collaborators for analysis by atomic absorption. The results show that the method is precise and accurate. The average relative SD for Pb was 5.2%, and for Cd, 3.9%, with average recoveries of 101% for both metals. The method has been adopted as official first action.

S

1 C 324

Collaborative study of a method for the atomic absorption spectrophotometric and polarographic determination of cadmium in food.

Rajan, R. J.; Gould, J. H.; Watts, J. O.; Fiorino, J.

Journal of the Association of Official Analytical Chemists 56 (4) 876-881 (1973) [2 ref. En] Div. of Chem. and Physics, FDA, Washington, DC 20204, USA]

The method studied involves acid digestion, dithionite extraction, and determination by atomic absorption spectrophotometry and polarography. This study consisted of 2 phases, with 10 lab. participating in Phase I and 15 lab. in Phase II. The 2 commodities studied (lettuce, potatoes, orange juice, shredded wheat, milk, sugar, eggs, fish, frankfurters, rice, beans, and oysters) were spiked at 0.05, 0.1, 0.2, 0.4, 0.5, 1.0, 1.5, and 2.0 ppm Cd. Only 3 collaborators submitted polarographic results. There were no statistically demonstrable differences for the atomic absorption method between spiking levels, commodities, or laboratories. Coefficients of variation were acceptable. The atomic absorption spectrophotometric method for determining Cd has been adopted as official first action. AS

11 J 1826

Toxic heavy metals in vegetables and forage grasses in Missouri's lead belt.

Hemphill, D. D.; Marienfeld, C. J.; Reddy, R. S.; Heidlage, W. D.; Pierce, J. O.

Journal of the Association of Official Analytical Chemists 56 (4) 994-998 (1973) [12 ref. En] [Environmental Health Surveillance Center, Univ. of Missouri, Columbia. 65201, USA]

Missouri supplies approximately 75% of the US production of lead. Lead poisoning of horses in the vicinity of one smelter alarmed local residents about the possible hazards of consuming their fruits and vegetables. County Extension Directors selected cooperators in 7 counties in the lead mining and smelting area and 3 "control" counties in north Missouri to grow lettuce, radishes, and greenbeans for toxic metal analysis. Seed and cultural instructions were furnished all cooperators. All samples were washed in distilled water. Atomic absorption analyses detected the following maximum levels of Pb in $\mu\text{g/g}$ dry weight: lettuce

leaf 1324, radish root 518, and greenbean pods 136. Cd levels in $\mu\text{g/g}$ dry weight were as follows: lettuce leaf 34.5, radish root 13.7, and greenbean pods 8.5. Vegetables from control counties contained markedly lower levels of Pb and Cd. AS

11 P 1600

Determination of lead and cadmium in tapwater, rainwater, milk and urine.

Holroyd, P. M.; Snodin, D. J.

Journal of the Association of Public Analysts 10 (4) 110-113 (1972) [6 ref. En] [Sci. Adviser's Dept., Canynge Hall, Whatley Road, Bristol, UK]

Procedures for the routine atomic-absorption determination (air-acetylene flame) of environmentally and clinically significant levels of Pb and Cd are described. The rapid concentration technique used is a simplification of that of Willis [Analytical Chemistry (1962) 34, 614] with ammonium pyrrolidine-1-carbodithioate as reagent. The metal-reagent complex is extracted into heptan-2-one, and the organic solution is aspirated into the instrument. The detection limits are 5 $\mu\text{g/kg}$ for Pb and 1 $\mu\text{g/kg}$ for Cd. [From Analytical Abstracts 25, 515.] AS

12 A 536

Determination of heavy metals in foods.

Baetz, R. A.; Kenner, C. T.

Journal of Agricultural and Food Chemistry 21 (3) 436-440 (1973) [14 ref. En] [Dept. of Chem., S. Methodist Univ., Dallas, Texas 75275, USA]

The proposed method utilized a V_2O_5 -catalysed $\text{HNO}_3/\text{H}_2/\text{H}_2\text{O}_2$ digestion followed by pH adjustment to 7.0 ± 0.5 . If a precipitate formed, it was filtered and analysed separately after being dissolved in acid. Heavy metals were removed from the digest with a column of Chelex 100 chelating ion-exchange resin in the sodium form. The metals were eluted from the column with 1N H_2SO_4 and were determined by atomic absorption. Sensitivity varied from 20 parts/billion for Zn to 0.20 ppm for Pb, and recoveries of added standards varied from 91.4% for Pb to 100.5% for Zn, with an overall average recovery of 95.2% and an average SD of 3.03%. The heavy metal content of 8 different types of foodstuffs has been determined. The proposed method can be used to determine Pb, Cd, Cu, Co, Mn, Ni, and Zn in biological materials in the ppm and parts/billion range on a single sample. AS

12 C 345

Working party on the monitoring of foodstuffs for heavy metals. Fourth report. Survey of cadmium in food. [Book]

UK Ministry of Agriculture, Fisheries & Food
Slip. SRN 11 2408319 (1973) [38 ref. En]

London, UK, H. M. Stationery Office Price £0.24

Approx. 4000 food samples (including total diet samples, individual food items, fish and shellfish) were analysed for Cd by atomic absorption spectrophotometry. Some conclusions are: the Cd content of the national diet is 0.01-0.02 mg/kg; average per capita daily intake of Cd is 15-30 µg; the highest Cd concn. were observed in brown meat of crabs, kidneys, and shellfish from the Bristol Channel; vegetables grown in the vicinity of certain metal refineries may have increased Cd concn.; in the case of leafy vegetables, much of this Cd is present on the outer leaves. AJDW

12 J 1966

[Lead, iron, zinc, cadmium and tin content of preserved foods.] Blei-, Eisen-, Zink-, Cadmium- und Zinngehalt konservierter Lebensmittel. Blumenthal, A.; Trottmann, K.

Alimenta 12 (4) 141-144 (1973) [7 ref. De, en, fr] [Zentral Lab. des Migros-Genossenschaftsbundes, Zurich, Switzerland]

Fruit and vegetables packaged in (i) jars, (ii) lacquered cans and (iii) unlacquered cans were analysed for heavy metals by atomic absorption spectroscopy. General trends were as follows: Fe - no significant difference between (i) and (ii) (range 1.5-4.6 ppm), concn. in (iii) increased markedly during storage (e.g. globe artichokes contained 5 ppm after 3 months and 157 ppm after 40 months); Zn - higher concn. in (iii) than in (i) (range 0.4-7.3 ppm) with no increase during storage; Cd - not detected; Sn - insignificant concn. (<10 ppm) in (i) and (ii), appreciable concn. in (iii), increasing during storage (e.g. globe artichokes contained 50 ppm after 3 months and 305 ppm after 40 months, asparagus contained >250 ppm after 3 months); Pb - higher concn. in (ii) and (iii) than in (i), no increase during storage (range 0.02-0.15 ppm in (i), exceptionally 3.7 ppm in lemon juice; 0.16-0.78 in cans, exceptionally 1.7 ppm in lemon juice). RM

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H. BROOKES

ASSISTANT EDITOR

1

[Simultaneous determination of cadmium and some other elements in unpolished rice by neutron activation analysis.]

Nagatsuka, S.; Tanizaki, Y.

Radioisotopes [Hoshasei Doigenso] 22 (5) 234-238 (1973) [4 ref. Ja, en] [Tokyo Metropolitan Isotope Res. Center, Japan]

Simultaneous determination of Cd and some other elements in unpolished rice by non-destructive and destructive activation analysis using a high resolution Ge(Li) detector was investigated. The samples were irradiated in a thermal neutron flux of $1.2 \times 10^{12} \text{ n cm}^{-2} \text{ s}^{-1}$ and irradiation times were 10 h for long-life nuclides and 10 min for short-life nuclides. In the destructive method, a column isotopic exchange technique by sodium bromide and potassium bromide mixture was tried for the removal of ^{24}Na , ^{42}K and ^{82}Br which were the most interfering elements in activation analysis of unpolished rice. It permitted removal of ^{24}Na , ^{42}K and almost all ^{82}Br simultaneously. In the analysis of unpolished rice samples obtained around Fuchu City, Tokyo, Cd, Cr, Zn, Sb, Mn, Na, K, Cl and Br were determined by the non-destructive method and Cu, As and a low content of Cd were detected only by the destructive method. From these results, it was concluded that several samples are polluted with Cd and other elements such as Sb, Cr and Br. AS

2

Cadmium found in rock scallops.

Anon.

Canner/Packer 141 (1) 41 (1972) [En]

Rock scallops from Corona del Mar and Anacapa Islands, California, have been found to contain concn. of Cd of 46.3 ppm in dry tissue and 6.9 ppm in wet tissue. The implications of these levels in view of the limit for Cd in drinking water of 0.01 ppm are discussed. PG

3

Cadmium content of sea water, bottom sediment and fish, and its elimination rate in fish. (In "Radiotracer studies of chemical residues in food and agriculture. Proceedings of a combined panel and research coordination meeting, organised by the Joint FAO/IAEA Division of Atomic Energy in Food & Agriculture, and held in Vienna, 25-29 October, 1971".)

Jaakkola, T.; Takahashi, H.; Soininen, R.; Riisanen, K.; Miettinen, J. K. (International Atomic Energy Agency) pp 69-75 (1972) [1 ref. En] Vienna, Austria, IAEA [Dept. of Radiochem., Univ. of Helsinki, Finland]

Cd was analysed in Finnish coastal water, bottom

1

sediment and fish. Samples were taken from the (i) Gulf of Bothnia, near 2 industrial cities with mineral industries and (ii) from non-polluted areas in the Gulf of Finland. Sea water from (ii) contained 0.1-0.2 $\text{pp}10^9 \text{ Cd}$ and from (i) 50-100 times more. Bottom sediments from (ii) contained 3-10 ppm and from (i) 15-130 ppm calculated on dry wt. of the organic material. Pike muscle from (ii) had the lowest concn. of Cd, about 2-3 $\text{pp}10^9/\text{fresh wt.}$, while liver contained about 10 times and kidney approx. 50 times more than muscle. Pike muscle from (i) contained 4-13 $\text{pp}10^9 \text{ Cd/fresh wt.}$, about 2-5 times more than samples from (ii). Muscles from the four-horned sculpin (*Myoxocottus quadrecornis*) from (i) contained 77 $\text{pp}10^9/\text{fresh wt.}$ This high level may be due to the fact that sculpin live close to the bottom sediment. The elimination rate of Cd in fish was studied by orally administering ^{109}Cd to 6 rainbow trout. After 42 days about 1% of the administered dose was retained in the whole body. The biological half-time is long and the slow elimination rate may lead to high Cd concn. in fish which may render them unsuitable for human consumption. VJG

4

Evaluation of mercury, lead, cadmium and the food additives amaranth, diethylpyrocabonate, and octyl gallate. Sixteenth report of the Joint FAO/WHO Expert Committee on food additives. Food & Agriculture Organization
FAO Nutrition Meetings Report Series 51A, 84pp. (1973) [many ref. En] [Rome, Italy]
See FSTA (1973) 5 8T388.

5

Problems associated with examination of food for metallic contamination (with special reference to EEC requirements).

Coles, L. E.

Proceedings of the Society for Analytical Chemistry 10 (7) 175-176 (1973) [5 ref. En] [Country Public Health Lab., The Parade, Cardiff, CF2 3UJ, UK]

6

[Investigation of harmful trace elements in food.]

Ko, I. S.; Ro, C. B.; Song, C.; Kwon, H. H.; Kim, K. S.; Chung, K. H.; Joo, C. B.

Report of the National Institute of Health 9, 389-406 (1972) [38 ref. Ko, en] [Dept. of Hygiene, Nat. Inst. of Health, Seoul, S. Korea]

Toxic trace elements were determined in foods commonly eaten in Korea; ranges of values determined were (ppm): Cu 0.01-7.60; Pb <0.01-0.83; Cd 0; Hg <0.01-0.09; As <0.01-0.13; Mn 0.01-11.5; and Zn <0.01-61.2. KoSfoST

7

[The extraction of cadmium from crockery.] Die Abgabe von Cadmium aus Geschirr.

Dömling, H.-J.

Zeitschrift für Analytische Chemie 267 (2) 118-121 (1973) [4 ref. De, en] [St. Chem.

Untersuchungsanstalt, D-8520 Erlangen, Henkestrasse 11, Federal Republic of Germany]

The extraction of Cd from 500 samples of coloured porcelain crockery was tested with a 4% acetic acid solution. After 24 h contact at room temp., 65% of samples had released no Cd, 10% <0.5 ppm and 25% >0.5 ppm, the max. permitted level in the USA. Cd levels >100 ppm were found in coloured porcelain crockery. Assuming a mean extraction of 2 ppm and a vol. of 250 ml for a plate, 500 µg of Cd would be extracted (i.e. 10 times the normal daily intake from food). In one case 13 mg has been extracted or $\frac{1}{3}$ the lethal dose. Under identical conditions, lemon juice, grapefruit juice and apple puree extracted amounts comparable to those extracted with acetic acid. Worcester sauce extracted more Cd than did acetic acid. Repeated extraction of the same article produced quantities of Cd greater than the US limit after 8 extractions. RM

8

[Cadmium content and distribution in mud, blood clams, fish flesh and in the algae, *Porphyra tenera*, in Ariake Bay.]

Ishio, S.; Ohba, N.; Tanaka, Y.; Tadokoro, S.

Bulletin of the Japanese Society of Scientific Fisheries [Nihon Suisan Gakkai-shi] 39 (6) 705-712 (1973) [4 ref. Ja, en]

Ariake Bay has been polluted by Cd from the wastes of Zn metallurgical plants of Ohmuta City. Analyses of Cd content were conducted on blood clams, fish flesh and *Porphyra tenera*. Based on an upper safety limit of 0.3 mg Cd/day/person, it was calculated that the intake of shucked blood clams should be restricted to 90-300 g/day/person. However, the amount of Cd detected in fish flesh was not significant. Content of Cd in *P. tenera* ranged from 0.3 to 4 ppm in DM; this is not considered to be a cause for concern since the quantity of this alga taken as food concern since the quantity of this alga taken as food in a day is not sufficient to result in a large intake of Cd. [From En summ.] AA

9

[Studies on the contents of mercury, cadmium, lead, and copper in edible seaweeds in Korea.]

Kim, C. Y.

Bulletin of the Korean Fisheries Society 5 (3) 88-96 (1972) [9 ref. Ko, en] [Pusan Fisheries Coll., S. Korea]

17 species of edible seaweeds were examined for their content. Concn. in air-dried

seaweeds were as follows: Hg 0.02-0.52 ppm, Cd 0.02-1.48 ppm, Pb 0.20-1.31 ppm, and Cu 0.90-17.0 ppm. KoSFoST

10

[Hair analysis - a method particularly for epidemiological studies involving determination of heavy metal burden in man and animals.] Die Haaranalyse - eine besonders für epidemiologische Untersuchungen geeignete Methode zur Feststellung von Schwermetallbelastungen bei Mensch und Tier.

Sterner, W.; Grahwit, G.

Archiv für Lebensmittelhygiene 24 (9) 203-208 (1973) [11 ref. De, en]

In continuation of preliminary studies [see preceding abstr.], the following mean values with SD [?] for Cd contents (ppm) were found in hair, liver, kidneys and muscles respectively of cattle in localities with different degree of Cd pollution (numbers of animals in parentheses): clean-air area (10), <0.05 for all, 0.045 ± 0.035 ; 0.148 ± 0.061 and trace; Hanover, slaughterhouse delivery area A (7), 0.609 ± 0.253 , 0.139 ± 0.099 , 0.465 ± 0.255 and trace; Hanover, area B (6), <0.05 for all, 0.077 ± 0.066 , 0.2 ± 0.12 and trace. In 2 polluted areas, Cd contents of hair of groups of 5 cattle were 3.30 ± 2.17 and 0.49 ± 0.17 ppm respectively. It is concluded that screening of hair for Pb and Cd is a useful method for assessing body contamination. SKK

11

Cadmium, lead and mercury content of various cured meats.

Kirkpatrick, D. C.; Coffin, D. E.

Journal of the Science of Food and Agriculture 24 (12) 1595-1598 (1973) [29 ref. En] [Food Res. Lab., Health Protection Branch, Dept. of Nat. Health and Welfare, Ottawa, Ontario, Canada]

Results are presented for the levels of Cd, Pb and Hg in 190 cured meat samples. The Cd content was in the range <0.01-0.22 ppm, the mean being 0.02 ppm; the range and mean of the Pb content were <0.01-0.42 and 0.06 ppm; the range and mean of the Hg content were <0.001-0.059 and 0.006 ppm. AS

12

[Residues in meat: pesticides and heavy metals.]

Rückstände in Fleisch. Pestizide und Schwermetalle.

Mirna, A.; Hecht, H.

Fleischwirtschaft 53 (9) 1212, 1214-1216 (1973) [De] [Bundesanstalt für Fleischforschung, 8650 Kulmbach, Federal Republic of Germany]

Possibilities for reducing pesticide residues discussed include reducing use of fatty tissues in meat products, and decomposing pesticides to compounds not stored in human tissue, e.g. decomposing DDT to DDD by fermentation with micrococci; during 38 days storage, DDT concn. of

fermented sausages was reduced to 30%. Concn. of As, Br, Cd, Cr, Hg, Sb, Se, Sn and Pb found in pork, beef and veal are tabulated, showing species-specific differences. Results are discussed with reference to permitted tolerance levels. RM

13

[Health risks resulting from the persistence of certain substances in water.]

Hernberg, S.

Brasserie Malterie Europe 23 (12) 285-286 (1973) [Fr] [Inst. de la Med. du Travail, Helsinki, Finland]

A study group, meeting in Helsinki in April 1972, recommended that the max. permitted levels of metals in drinking water should be (as mg/l.): As, 0.05; Cd, 0.005; Pb, 0.05; Mn, 0.5; and Hg, 0.001. Further studies on the distribution, metabolism and toxicity of metals, and on the standardization of analytical methods were recommended. MEG

14

Cadmium analysis of dried milk by pulse polarographic techniques.

Cornell, D. G.; Pallansch, M. J.

Journal of Dairy Science 56 (12) 1479-1485 (1973) [27 ref. En] [Dairy Products Lab., USDA, Washington, DC, USA]

The applicability of differential pulse anodic stripping voltammetry for the determination of low levels of Cd in milk has been demonstrated. Sample preparation included dry ashing and dissolving the ash in HCl. Highest recovery of Cd was with ashing temp. between 500 and 540°C. Cadmium recovery was 94% in dried milk with 0.01 ppm added Cd and 86% with 0.002 ppm added. Samples of foam spray-dried skim-milk and freeze-dried whole milk contained <0.003 ppm Cd on a dry wt. basis. AS

15

Heavy metal accumulation in oysters grown in Tasmanian waters.

Thrower, S. J.; Eustace, I. J.

Food Technology in Australia 25 (11) 546-547, 549, 551-553 (1973) [36 ref. En] [CSIRO Div. of Food Res., Tasmanian Food Res. Unit., Hobart, 7000, Australia]

Abnormally high concn. of Zn, Cd, and Cu were found in oysters grown in the Derwent and Tamar Estuaries. Individual oysters contained concn. of Zn, Cd and Cu as high as 21 000 ppm, 63 ppm and 450 ppm wet wt. respectively. High concn. of Zn and Cd in oysters from an area in the Derwent Estuary probably caused symptoms of nausea and vomiting experienced by some people after eating them. A subsequent survey of oysters growing in areas remote from centres of population and industry, where heavy metal pollution might be expected to be minimal, showed levels of accumulation of the 3 metals which were similar to

levels reported from other parts of the world. None of the oysters examined complied with current food regulations. AS

16

[The importance of food research chemists in environmental protection.] Die Bedeutung des Lebensmittelchemikers aus dem Forschungsbereich für den Umweltschutz.

Fresenius, W.

Deutsche Lebensmittel-Rundschau 70 (1) 13-15

(1974) [14 ref. De] [Inst. Fresenius, Chem. & Biologische Lab. GmbH, 6200 Wiesbaden, Kapellenstrasse 11-15, Federal Republic of Germany]

Problems of the contamination of foods and water with aflatoxins, heavy metals, biocides, nitrosamines and polycyclic aromatic hydrocarbons are discussed, with special reference to sampling methods and analytical techniques. AJDW

17

Chemical contaminants in milk. [Review]

Kroger, M.

Milchwissenschaft 28 (12) 753-757 (1973) [24 ref. En, de] [Pennsylvania St. Univ., Div. of Food Sci. and Ind., University Park, 16802, USA]

In this review the author covers pesticides, industrial chemicals (chlorinated biphenyls), antibiotics and other drugs, metals and other inorganic substances, radionuclides, detergents and disinfectants, and naturally occurring toxic substances (from poisonous plants etc.). FL

18

[Current questions in food legislation.] Aktuelle Fragen des Lebensmittelrechts.

Eckert, D.

Deutsche Lebensmittel-Rundschau 70 (1) 27-31 (1974) [De] [Bundesministerium für Jugend, Familie und Gesundheit, 53 Bonn-Bad Godesberg, Deutschherrenstrasse 87, Federal Republic of Germany]

Developments in legislation for foods in the Federal Republic of Germany are discussed, with special reference to low-calorie foods, nutritional labelling, wt. labelling, data marking, definitions, heavy metal and pesticide residues, and dietetic products. Developments in EEC legislation are also briefly discussed. AJDW

19

Determination of low levels of cadmium in foods using a chelating ion exchange resin.

Baetz, R. A.; Kenner, C. T.

Journal of the Association of Official Analytical Chemists 57 (1) 14-17 (1974) [10 ref. En]

[FDA, 3032 Bryan St., Dallas, Texas 75204, USA]

A method is described for the determination of Cd in foods which utilizes the AOAC HNO_3 , H_2SO_4 , H_2O_2 digestion procedure catalysed by V_2O_5 . The Cd is separated from the neutralized digest by a chelating ion exchange resin, eluted with H_2SO_4 , and determined by atomic absorption spectrophotometry. The average recovery of 0.30 ppm Cd added to 7 commodities [lettuce, frozen orange juice, milk, sugar, canned vegetarian beans, rice, shell eggs] was 94% with a SD of 2.8%, which compares favourably with the AOAC dithizone extraction method. The transfer, washing, and elution of 6 samples by the proposed method require approx. 2 h. The method allows the determination of as little as 10 μg Cd/kg. AS

20

Effect of dietary cadmium on growth, cadmium absorption and cadmium tissue levels in growing lambs.

Doyle, J. J.; Pfander, W. H.; Grebing, S. E.; Pierce, J. O., II

Journal of Nutrition 104 (2) 160-166 (1974) [30 ref. En] [Dept. of Animal Husbandry, Univ. of Missouri, Columbia, 65201, USA]

21

[The changing environment: advantages and dangers in nutrition.] Veränderte Umwelt: Gewinn und Gefahren für unsere Ernährung. Aebi, H.

Ernährungs-Umschau 20 (12) 471-477 (1973) [12 ref. De, en] [Med.-Chem. Inst., Univ., Bern, Switzerland]

This lecture presented at a meeting in Saarbrücken in Oct. 1973 in commemoration of the 20th anniversary of the German Nutrition Society deals mainly with trends in bread consumption, contamination of food with heavy metals, antibiotics, pesticides, hormones, biotoxins, plastics, and paint components at different stages of production, packaging and distribution, and with positive developments in food synthesis and application. SKK

22

The toxic potential of trace metals in foods. A review

Somers, E.

Journal of Food Science 39 (2) 215-217 (1974) [13 ref. En] [Food Res. Lab., Dept. of Nat. Health & Welfare, Ottawa, Canada K1A 0L2]

Foods contain trace amounts of a wide range of heavy metals; some of these have a biochemical function, others are contaminants. Trace metals can contaminate foods through agricultural technology, industrial pollution, geological sources and food processing. Some results from recent Canadian monitoring surveys are given with particular emphasis on data from Pb and Cd analyses.

Consideration is given to the criteria that can be used to determine the priorities in the design of a monitoring programme for trace metals in foods. IFT

23

Effect of essential minerals on cadmium toxicity. A review.

Fox, M. R. S.

Journal of Food Science 39 (2) 321-324 (1974) [47 ref. En] [Div. of Nutr., Bureau of Foods, FDA, Dept. of Health, Education & Welfare, Washington, DC 20204, USA]

Cd is a toxic element that has no known beneficial effects in living organisms. At levels several-fold above the average intake of 50 μg /day for man in the US, Cd can interfere with the metabolism of the essential elements Fe, Ca, Zn, Mn and Cu. Antagonism of the first 2 elements has been observed in man and the last 3 in experimental animals only. A major effect of high levels of dietary Cd appears to be interference with absorption of essential minerals. Excess dietary intakes of essential minerals can either decrease or eliminate some of these effects of Cd, as well as result in decreased Cd concn. in the kidney, a target organ for Cd accumulation and functional damage. Environmental toxicants such as Cd cannot be completely avoided. It is important, therefore, to define low intake levels of essential nutrients at which toxicity of Cd is exacerbated and high intake levels of essential nutrients at which toxicity of Cd is minimized. IFT

24

[Harmful compounds in cereals - a problem of consumer protection.] Schadstoffe in Getreide - ein Problem des Verbraucherschutzes. [Lecture]

Seibel, W.; Ocker, H. D.

Mühle + Mischfutterschnik 111 (11) 163-166 (1974) [11 ref. De] [Bundesforschungsanstalt für Getreideverarbeitung, Detmold, Federal Republic of Germany]

Max. permitted levels, origins, occurrence, effects of processing, and alternatives to using harmful compounds in cereals and cereal products are discussed. Harmful substances include radioactive compounds, heavy metals (e.g. As, Pb, Cd, Hg), carcinogenic hydrocarbons (e.g. benzpyrene), mycotoxins, and residues of pesticides and preservatives. While processing (hulling, milling) reduces levels in flour by 50-80%, it enriches by-products which may be used in animal feed. Alternative methods are recommended which would reduce the level of contamination e.g. using non-persistent pesticides instead of persistent ones. RM

25

[Present-day knowledge on milk hygiene with particular reference to the problem of residues.]

Milchhygiene aus heutiger Sicht unter besonderer Berücksichtigung des Rückstandsproblems.

[Review]

Kreuzer, W.

Wiener Tierärztliche Monatsschrift 61 (2) 57-66 (1974) [54 ref. De, en] [Bereich für Hygiene und Tech. der Lebensmittel tierischen Ursprungs, Tierärztliche Fak., Univ., Munich, Federal Republic of Germany]

Problems of milk hygiene, especially microbiological quality of milk and residues of various substances (antibiotics, disinfectants, mycotoxins, organochlorine pesticides, Pb, Cd, Hg, and radionuclides) in dairy products, are discussed in relation to animal health and milk handling and processing. It is pointed out that the present situation of residues in dairy products, although not constituting a hazard for healthy adults, has reached a critical stage as far as children and sick persons are concerned. ADL

26

[Biocides and toxic trace substances in the food chain soil-plants-milk-man.] Biozide und toxische Spurenstoffe in der Nahrungskette Boden-Pflanze-Milch-Mensch.

Tolle, A.; Heeschen, W.; Blüthgen, A.

Fortschritte der Veterinärmedizin No. 20, 197-206 (1974) [12 ref. De] [Inst. für Hygiene der Bundesanstalt für MilCHForschung, Kiel, Federal Republic of Germany]

This paper, presented at the 10th Congress of the German Veterinary Society (12-14 April 1973, Bad Nauheim, Federal Republic of Germany) gives brief details of the origin, tolerance limits and trends in the concn. of contaminants (organochlorine insecticides, antibiotics, Pb, Hg and Cd) in milk in the Federal Republic of Germany. Studies conducted over the period 1969-1973 show that, during this period, the concn. of residues of DDT and its metabolites have decreased by 71%; corresponding values for heptachlor + heptachlor epoxide, aldrin + dieldrin and lindane were 66%, 78% and 38% respectively. The incidence of antibiotic residues in raw milk has decreased from 2.4% to 0.5%; no antibiotics were found in pasteurized milk in the retail trade. Concn. of heavy metals and Se in milk present no significant health hazard. [See also FSTA (1974) 6 7P1040.] AJDW

27

Heavy metals in Tasmanian oysters in 1972.

Thrower, S. J.; Eustace, I. J.

Australian Fisheries 32 (10) 7-10 (1973) [11 ref. En] [CSIRO Div. Food Res., Hobart, Australia]

Samples of oysters from 20 sites around Tasmania were collected and analysed for Cd, Cu and Zn by atomic absorption spectroscopy. Metal concn. (ppm) found were: Zn, from 561 ± 360 to 7670 ± 2390 ; Cs, from <2.0 to 19.8 ± 8.7 ; Cu, from 21 ± 10 to 124 ± 24 . It is concluded that a background level of contamination must be expected in all oysters, but oysters from commercial leases showed very high levels of heavy metals. JN

28

Organic solvent extraction of lead and cadmium from aqueous solutions for atomic absorption spectrophotometric measurement.

Childs, E. A.; Gaffke, J. N.

Journal of the Association of Official Analytical Chemists 57 (2) 360-364 (1974) [6 ref. En] [Seafoods Lab., Dept. of Food Sci. and Tech., Oregon St. Univ., 250 36th Street, Astoria, 97103, USA]

The efficiency of solvent extraction of Pb and Cd for atomic absorption spectrophotometry was investigated. Quantitative extraction from an aqueous solution into methyl isobutyl ketone was possible, using sodium diethyl dithiocarbamate in the pH range of 5.5-8.5 for Cd and 5.5-7.5 for Pb. A 4-fold concn. from aqueous or organic solvent allowed accurate measurement (error $< \pm 10\%$) of concn. $< 0.02 \mu\text{g Pb/ml}$ and $< 0.05 \mu\text{g Cd/ml}$. Detection limits of $0.01 \mu\text{g Pb/ml}$ and $0.0005 \mu\text{g Cd/ml}$ were established. This method has been used successfully to measure the Pb and Cd content of fish muscle. AS

29

Substoichiometric determination of cadmium in biological samples.

Bibr, B.; Lener, J.; Zeman, A.

Journal of Radioanalytical Chemistry 3 (1/2) 81-86 (1969) [13 ref. En] [Dept. of Nuclear Chem., Fac. of Tech. & Nuclear Physics, Prague, Czechoslovakia]

A method is suggested for the detn. of submicrogram Cd in quantities by isotope dilution, using substoichiometric extraction into dithizone in chloroform. The applicability of the method was tested in biological samples. Extraction was carried out from a sodium acetate buffer between pH 9.7 and 12.0. With an amount of $0.2 \mu\text{g}$ of Cd, the S.E. was not greater than $1 \mu\text{g}$. This method is suitable for the analysis of trace amounts of Cd in biological materials. AS

30

Cadmium and cobalt in tea and coffee and their relationship to cardiovascular disease.

Horwitz, C.; Linden, S. E. van der
South African Medical Journal 48 (6) 230-233
(1974) [33 ref. En] [Nat. Res. Inst. Occupational
Diseases, Univ., Cape Town]

The Cd content of 5 teas, analysed by atomic absorption spectrophotometry, was found to average 0.0298 µg/g tea, whilst that of 7 coffees averaged 0.03 µg/g coffee. Bush tea had the lowest Cd content (0.017 µg) and pure instant coffee powder the highest (0.035 µg). As regards cobalt content, 5 teas averaged 0.20 µg/g and 7 coffees 0.93 µg/g. Again bush tea contained the lowest and a brand of pure instant coffee powder the highest cobalt contents. It would appear that tea and coffee provide only a very small proportion of the total intake of these elements, even with heavy drinkers, and no firm conclusions can be drawn concerning their toxicity from these sources. EJM

31

[Anodic stripping voltametry for the determination of copper, lead and cadmium with subsequent colorimetric determination of iron in caseins.]

Invers-Polarographische Bestimmung von Kupfer, Blei und Cadmium sowie anschließende kolorimetrische Eisenbestimmung aus einem Aufschluss in Caseinen.

Mrowetz, G.; Thomasow, J.

Milchwissenschaft 29 (2) 74-78 (1974) [4 ref. De, en] [Bundesanstalt für Milchforschung, Kiel, Federal Republic of Germany]

Cu, Pb and Cd contents of casein are determined by inverse polarography at 25°C of a diluted sulphuric/perchloric acid digest of 0.2 g casein. Fe is subsequently determined colorimetrically in the same diluted digest by addition of bathopenanthroline, extraction of the coloured complex with hexanol and measurement of its extinction at 533 nm. Limits of detection of Cu, Pb and Cd were 0.1 ppm and of Fe 1.0 ppm, corresponding recoveries of these metals when added were over 90% for the first 3 and about 97% for Fe. Commercial caseins examined (12) contained 0.9-4.9 ppm Cu, 0.1-2.1 ppm Pb, <0.1 ppm Cd and 3-33 ppm Fe. GTP

32

Possible interference in the measurement of lead and cadmium from elements found in fish muscle.

Childs, E. A.; Gaffke, J. N.

Journal of the Association of Official Analytical Chemists 57 (2) 365-367 (1974) [2 ref. En] [Seafoods Lab., Dept. of Food Sci. and Tech., Oregon St. Univ., 250 36th Street, Astoria, 97103, USA]

The effects of various elements found in fish muscle on the measurement of Pb and Cd by

atomic absorption spectrophotometry in either an aqueous or an organic solvent system were evaluated. Although a number of elements altered the measurement, the composite effect for both Cd and Pb in either solvent system was $\pm 10\%$. The extent of interference of all added elements was found to be a function of the amount of Pb or Cd present. AS

33

[Contents of heavy metals in foods. I.]

Tanaka, Y.; Ikebe, K.; Tanaka, R.; Kunita, N.
Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 14 (2) 196-201
(1973) [11 ref. Ja] [Osaka Pref. Inst. of Public Health, 3-69 Nakamichi 1-chome, Higashinari-ku]

Seven kinds of heavy metals such as Cd, Zn, Mn, Cu, Pb, As and total-Hg were analysed in a number of agricultural and marine products and chicken eggs, and the results tabulated. TM

34

[Use of polarography and oscillographic polarography in food analysis.] Anwendung der Polarographie und der oszillographischen Polarographie mit Wechselstrom in der Lebensmittelanalyse.

Malkus, Z.

Nahrung 18 (3) 323-328 (1974) [60 ref. De] [Inst. für Hygiene & Epidemiologie, Forschungsstelle für Nahrungs- & Ernährungshygiene, Prague, Czechoslovakia]

Polarographic detn. of heavy metals, carbohydrates, carbonyl compounds, vitamins, amino acids, proteins, preservatives and additives and contaminants in foods is discussed, with reference to literature data. IN

35

Abstracts of papers to be presented at the Sixty-Ninth Annual Meeting, Manufacturing section, Chemistry.

United States of America, American Dairy Science Association

Journal of Dairy Science 57 (5) 587-589 (1974) [En]

Papers in this section include: Evaluation of each method in a procedure for analysis of free fatty acids in milk fat, by J. D. White & A. H. Duthie (M33); Detection of lipase flavor in butter, by L. I. Bell & J. G. Parsons (M34); Distribution and removal of mercury from milk, by J. K. Roh & R. L. Bradley, Jr. (M35); Determination of selenium in fresh and stored raw milk and its fractions, by A. Patel, M. Loewenstein, R. A. Isaac & W. C. Johnson, Jr. (M36); Lead and cadmium in California milk, by J. C. Bruhn & A. A. Franke (M37); Factors affecting incidence of autoxidation in milk, by M. Loewenstein, W. J. Pell, C. M. Cotton

& O. T. Fosgate (M38); Autoxidation in California herd milks, by J. C. Bruhn, A. A. Franke & G. S. Goble (M39); Effect of supplementing cow rations with high protein feeds on amines in milk, by R. S. Mehta, R. Bassette & E. E. Bartley (M40); Effect of milk clotting enzymes on determination of casein by dye binding, by M. E. Mohammed & R. Mickelsen (M41); Fat test accuracy as related to sampling procedures, by C. B. Reeves (M43); and Fat composition of fluid milk in selected Midwest markets, by D. A. Seiberling & J. R. Miller. CDP

36

[A rapid thin layer chromatographic test for toxic metals in water.] Dünnschicht-chromatographischer Schnelltest auf toxische Metalle in Wasser.

Schwedt, G.; Lippmann, C.

Deutsche Lebensmittel-Rundschau 70 (6) 204-206 (1974) [3 ref. De, en, fr] [Chem. Untersuchungsamt, Hagen, Federal Republic of Germany]

A rapid test for heavy metals (Bi, Cd, Co, Cu, Fe, Hg, Ni, Pb, Zn) in water is described. Interfering substances (e.g. detergents, oils) are first separated from the water by extraction with chloroform. The heavy metals are then extracted at pH 4.6 as diethyldithiocarbamate derivatives; the extract is evaporated to dryness, dissolved in acetone/chloroform (1:1) and separated on kieselgel TLC plates using a benzene or a benzene/hexane (5:1) solvent system. The metals are identified by their characteristic colour reactions with dithizone. Detection limit for the individual metals is <1 µg, except for Bi which has a higher detection limit [not given]. AJDW

37

[Determination of toxic metals in meat by X-ray fluorescence analysis.] Schadmetallbestimmung in Fleisch mit Hilfe der Röntgenfluoreszenzanalyse. Forschner, E.; Wildanger, W.; Beitz, L.; Haase, I.; Müller, L. *Fleischwirtschaft* 54 (3) 529-531 (1974) [4 ref. De, en, fr] [St. Veterinäruntersuchungsamt, 3300 Braunschweig, Hohetorwall 14, Federal Republic of Germany]

Methods for determination of As, Sn, Cd, Pb and Hg in meat or muscle biopsies are discussed, with reference to proposed tolerances in the Federal Republic of Germany. Limitations of atomic absorption spectroscopy, inverse polarography and neutron activation analysis are discussed. X-ray fluorescence spectroscopic studies on samples of minced meat (containing 0.01-5.0 ppm of added As, Sn, Cd, Pb or Hg salts, singly or in combination) are described. Detection limits for 200 s and 1000 s determination times were, respectively (ppm): Pb 0.07 and 0.03; As 0.035 and 0.015; Hg 0.065 and 0.03; Sb 0.55 and 0.25; and Cd 0.076 and 0.03. Good agreement was obtained for determination of the metals alone or in mixtures. RM

38

[Determination of cadmium in foods.] Zur Analyse von Cadmium in Lebensmitteln.

Woidich, H.; Pfannhauser, W.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 155 (2) 72-76 (1974) [33 ref. De, en] [Forschungsinst. der Ernährungswirtschaft, A-1190 Vienna XIX, Austria]

Detn. of Cd in foods by the photometric method with dithizon and by atomic absorption spectrophotometry (AAS) is described. Both methods were found suitable for routine analysis and gave similar results, but AAS was much more sensitive. Recoveries of Cd added to fish samples were 97.9 and 99.4% respectively. The following mean values with ranges (method not specified) are quoted for foods on the Austrian market (ppm, number of samples in parentheses): maize (3), not stated and 0.59-1.05; wheat (13), 0.24 and 0.006-1.05; oats (4), not stated and 1.1-1.93; barley (4), not stated and 0.05-0.17; rye (4), not stated and 0.125-0.27; shell molluscs, (39), 0.31 and 0.05-1.74; tuna (13), 0.14 and 0.05-0.97; sardines (27), 0.23 and <0.05-1.00; other fish (65), 0.13 and 0.05-1.46; pig kidney (15), 0.15 and 0.01-0.41; and pig meat (15), 0.014 and 0.008-0.025. SKK

39

Environmental quality and safety. Global aspects of chemistry, toxicology and technology as applied to the environment. Vol. II. [Book]

Coulston, F.; Korte, F. (Editors)

xviii + 333pp. ISBN 3 13 498001 0 & ISBN 0 12 227002 9 (1973) [many ref. En, de] Stuttgart, Federal Republic of Germany; G. Thieme Verlag, New York, USA, Academic Press, Inc.

[Contd. from preceding abstr.] Cadmium content in sea water, bottom sediment, fish, lichen, and elk in Finland, by T. Jaakkola, H. Takahashi & J. K. Miettinen (pp. 230-237, 24 ref.) Research in the Gesellschaft für Strahlen- und Umweltforschung on the evaluation of the risks involved in environmental chemicals, by W. Klein (pp. 244-247); Economics of fertilizer use by US farmers - productivity and the environment, by V. W. Davies (pp. 260-270, 8 ref.); Economical importance of chemical crop protection in relation to its ecological impact, by W. Salzer (pp. 271-280, 11 ref.); and WHO's food safety programs and the problem of mercury as a food contaminant, by F. C. Lu (pp. 309-319, 29 ref.). [For vol. I see FSTA (1973) 5 7C179, 5 7C180, 5 8C244, 5 8C237, 5 7P945, 5 8H1132.] GL

40

[Air pollution and vegetable cultivation.]

Luftverunreinigung und Gemüsebau.

Kloke, A.

Leberbpartner 28 (11) 402-404 (1974) [De] [Biol. Bundesanstalt, Berlin (West)-Dahlem]

This review-type article deals with S, F, Cd, Hg and Pb contamination of vegetable crops and with some factors influencing the contamination. SKK

0.002-0.010; rusks 0.05-0.15 and 0.025-0.065; canned foods 0.05-0.20 and 0.010-0.080; and bottled foods <0.05-0.15 and <0.005-0.060. AJDW

41

[Effects of light on migration of cadmium from cadmium-pigmented plastics.] Der Lichteinfluss beim Migrationstest von Cadmium aus cadmiumpigmentierten Kunststoffen.

Endriss, H.

Deutsche Lebensmittel-Rundschau 70 (7) 243-247 (1974) [8 ref. De, en, fr]

Details are given of studies on the effect of light on migration of Cd from various plastics (pigmented with cadmium red or cadmium yellow) into food simulants (water, 3 or 30% acetic acid solution, or 1 or 10% ethanol solution). Migration tests were conducted for ≤ 30 days at various temp. The results showed that Cd migration from illuminated samples was up to 100 times greater than migration out of non-illuminated samples; the effects of illumination increased with increasing duration of the migration test. Pre-exposure of the plastics to light before migration tests in the dark had no significant effect on Cd migration. The results are discussed with reference to the inaccuracy of migration tests conducted under uncontrolled light conditions, and possible effects of the opacity of the plastics on Cd migration into foods in illuminated Cd-pigmented plastics packs. AJDW

42

Lead and cadmium in baby foods.

Snodin, D. J.

Journal of the Association of Public Analysts 11 (4) 112-119 (1973) [36 ref. En] [Sci. Adviser's Dept., Canynge Hall, Whatley Road, Bristol BS8 2PR, UK]

A solvent extraction/atomic absorption method for detn. of Pb and Cd in baby foods is described. 10 g homogenized samples are dry ashed, treated with 5 ml water and 5 ml HCl, evaporated to dryness, mixed with 1.0 ml HCl and 3-5 ml water, and made up to 25 ml. Immediately after addition of 0.5 ml 10% ascorbic acid, 1.50 ml of 1% diethylammonium diethylthiocarbamate solution in methyl isobutyl ketone is added, and the mixture is shaken for 30 s. The organic layer is then aspirated into the spectrophotometer. No significant interference by Fe, Zn or Cu was observed. The reproducibility of the method was acceptable; recovery was 70-95% for Pb, and 90% for Cd. For a 10 g sample, the detection limit was 0.02 ppm Pb and 0.002 ppm Cd. Tables of values are given for the Pb and Cd concn. in 8 samples of dried milk, 21 samples of other dried foods, 3 samples of rusks, 7 samples of canned baby foods and 7 samples of bottled baby foods. Ranges of values (for Pb and Cd respectively) were (ppm); dried milk <0.01 and 0.001-0.004; other dried foods <0.01-0.12 and

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[Determination of cadmium in biological and other materials by atomic absorption spectrophotometry.

I. Sources of error and their elimination during ashing and preparation of solutions for analysis.]

Bestimmung von Cadmium in biologischen und anderen Materialien mit Hilfe der Atomabsorptionsspektrophotometrie (AAS). I. Fehlermöglichkeiten und deren Eliminierung bei der Veraschung und Herstellung der Analysenlösung.

Oelschläger, W.; Bestenlehner, L.

Landwirtschaftliche Forschung 27 (1) 62-69

(1974) [26 ref. De, en, fr] [Fachgruppe 9, Abteilung Tierernährung, Univ., Hohenheim, Federal Republic of Germany]

Sources of error in dry ashing of biological materials (including foods) and preparation of solutions for detn. of Cd are discussed, including: the concn. of Cd in analytical reagents; losses of Cd during ashing at high temp., as a result of volatilization of Cd or reaction of Cd with the ashing container; and binding of Cd in samples with a high silicic acid concn. Tables of values are given for the recovery of Cd from samples of rapeseed meal, fish meal, liver and kidney tissue ashed at temp. of 420-750°C, demonstrating the decreasing Cd recovery with increasing temp. A method for ashing and solution preparation (developed to avoid the above sources of error) is described, based on dry ashing at 420-450°C in a platinum crucible, use of high-purity HCl for Cd extraction, and use of HF to decompose silicic acid residues. [See also following abstr.] AJDW

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[Determination of cadmium in biological and other materials by atomic absorption spectrophotometry.

II. Sources of error and their elimination in atomic absorption spectrophotometric analysis.]

Bestimmung von Cadmium in biologischen und anderen Materialien mit Hilfe der Atomabsorptionsspektrophotometrie (AAS). II. Fehlermöglichkeiten und deren Eliminierung bei der AAS-Bestimmung.

Oelschläger, W.; Bühler, E.

Landwirtschaftliche Forschung 27 (1) 70-79

(1974) [5 ref. De, en, fr] [Fachgruppe 9, Abteilung Tierernährung, Univ., Hohenheim, Federal Republic of Germany]

Sources of error in detn. of Cd in foods and other materials by atomic absorption spectrophotometry (AAS) are discussed, including effects of HCl concn. in the solution under test, and interference by Na, Ca, K, Mg, O, Pb, Zn, Cu or Co. Studies on the suitability of extraction with dithizone/chloroform for elimination of interference by other cations are briefly described; tables of values for the Cd concn. of various foods

(determined with and without extraction with dithizone/chloroform) are given, demonstrating the considerable inaccuracies resulting from interference by other cations. A method for AAS detn. of Cd is described: an aliquot of the Cd-containing HCl- extract [see preceding abstr. for method of preparation] is shaken with ammonium citrate solution (adjusted to pH 9.2 with conc. NH_4OH) and a 0.05% solution of dithizone in chloroform; the chloroform layer is then separated, and shaken with 0.5N HCl. The aqueous layer is then separated, and the Cd concn. determined by AAS. A series of trials with standard solution showed the SD of the results to be ± 0.076 . AJDW

45

Health hazards of environmental cadmium pollution. [Review]

Nordberg, G. F.

Ambio 3 (2) 55-66 (1974) [64 ref. En]

[Karolinska Inst., S-104 01 Stockholm, Sweden]

Sources and occurrence of Cd and intake by humans are described, and Cd levels in foods (meat, fish, grains, vegetables, beverages, fruits) from non-contaminated areas in various countries are listed; it is concluded that present standards for daily intake do not allow adequate safety margins. The rate of Cd in humans and problems of its analysis are discussed, and known effects of this metal, e.g. renal damage, anaemia, hypertension and liver damage, are considered. Data on epidemiological studies of Itai-Itai disease in Japan are reviewed. CDP

46

Lead and cadmium content of selected Oregon groundfish.

Childs, E. A.; Gaffke, J. N.

Journal of Food Science 39 (4) 853-854 (1974)

[11 ref. En] [Oregon St. Univ., Seafoods Lab., Astoria, 97103, USA]

The Pb and Cd content of selected Oregon groundfish was determined. Rex sole (*Glyptocephalus zachirus*), English sole (*Parophrys vetulus*), Dover sole (*Microstomus pacificus*), petrale sole (*Eopsetta jordani*), orange rockfish (*Sebastes pinniger*), lingcod (*Ophiodon elongatus*), Pacific hake (*Merluccius productus*), starry flounder (*Platichthys stellatus*) and sand sole (*Psettichthys melanostictus*) samples had mean Pb and Cd contents of < 0.25 ppm. Therefore Oregon groundfish would not be a source of toxic levels of Pb and Cd in the diet. [See also FSTA (1974) 6 3R141.] IFT

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Synthetic Dairy Products	31	Lactic Acid Bacteria in Beverages and Food
Acidulants in Foods	32	Colorants
Agglomeration of Powders	33	Browning of Foods
Aseptic Packaging	34	Aflatoxins
EEC Regulations	35	Antibiotic Properties and Residues in Food (Excl. Nisin)
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Viscosity of Foods	38	Coffee
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Taints in Foods	40	Arsenic in Foods
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FAB 37

CADMIUM IN FOODS

SELECTED FROM VOLUME **7**

FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

under the direction of

Commonwealth Agricultural Bureaux, Farnham Royal, Bucks; Gesellschaft für Information und Dokumentation, Frankfurt am Main; Institute of Food Technologists, Chicago; Centrum voor Landbouwpublikaties en Landbouwdocumentatie (Pudoc), Wageningen.

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Some of the larger FABs have been divided into sections to facilitate use. Abstracts are not printed in more than one section. The larger FABs also have subject indexes provided.

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Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journal patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES

ASSISTANT EDITOR

residues (at meat inspection.)

Pekkanen, T. J.; Seuna, E.-R.; Stabel-Taucher, R. *Acta Veterinaria Scandinavica* 15 (3) 436-438 (1974) [7 ref. En] [Dept. of Food Hygiene, Coll. of Vet. Med., 55006 Helsinki, Finland]

Samples of fresh kidney tissue from 19 horses were analysed for Cd, and tested for inhibitory activity by the method of Lorenzen [Archiv für Lebensmittelhygiene (1967) 18 (2) 30-32] using *Sarcina lutea* ATCC 9341 as the test organisms. To evaluate the inhibitory activity of Cd, pieces of filter paper soaked in solutions containing 20-100 mg Cd/l. were also tested by Lorenzen's method. The horse kidney samples contained 30.7-108.0 mg Cd/kg wet wt. (mean 59.0 ± 21.9 mg/kg). All were inhibitory, the width of the inhibition zone being approx. proportional to the Cd concn. The studies on Cd-impregnated filter papers showed that Cd concn. ≥ 30 mg/l. were inhibitory, the inhibition zone increasing with increasing Cd concn. It is suggested that the high incidence of false positives in tests for inhibitory substances in horse kidneys may be due to inhibitory effects of the high Cd concn. in this organ. AJDW

4

Health laws and regulations - Denmark.

World Health Organization

International Digest of Health Legislation 24 (4) 744-777 (1973) [En] [Geneva, Switzerland]

A selection of Danish health laws and regulations is presented including the following which relate to food hygiene: Order No. 449 of 9 Oct., 1972 on minarine (a spreadable emulsion containing ≥ 39 and $\leq 41\%$ fat and $\geq 5\%$ water); Order No. 450 of 11 Oct., 1972, on ceramic and enamelled articles and glassware for use in connection with foodstuffs, which prescribes permissible levels of Pb and Cd to be released from food utensils; Order No. 492 of 24 Nov., 1972, to amend the Order concerning milk and cream, and products derived from milk (milk products) (principal amendments relate to partly skimmed milk with fat content 1.50-1.80%, min. fat content of double cream, and vitamin A and D addition to partly skimmed milk); Law No. 186 of 30 March, 1973, on the production of dairy products, wholesale trade in these products etc. (applies to production, handling, treatment import and export of, and wholesale trade in butter, cheese, milk product preserves and ice-cream and milk ices);

VJG

5

[Toxic heavy metals as contaminants in foods.]

Toxische Schwermetalle in unserer Umwelt, Fremdstoffe in der Nahrung.

Woggon, H.

Ernährungsforschung 19 (3) 72-74 (1974) [De] [Zentralinst. für Ernährung, Potsdam-Rehbrücke, German Democratic Republic]

[Removal of cadmium from rice grain by use of sulphonate surfactants.]

Mitsuda, H.; Tomiyama, S.-I.; Deura, H.

Journal of the Japanese Society of Food and Nutrition [Eiyo to Shokuryo] 27 (3) 125-131 (1974) [17 ref. Ja, en] [Dept. of Food and Tech., Kyoto Univ., Japan]

Conditions suitable for removal of residual Cd from rice by treatment with surfactants were studied. Neither the fat fraction nor the carbohydrate fraction of polished rice contained any significant amount of Cd. Cd occurred mostly in the protein fraction in a bound state. Both Cd and protein were efficiently removed from polished rice by treatment with sodium alkylbenzene sulphonate or sodium alkenyl sulphonate. In each case there was a correlation between Cd and protein with regard to efficiency of removal. The difference in the alkyl group of the surfactant did not affect the efficiency of Cd and protein removal. It was considered that the sulphonate surfactants interacted with rice protein during washing to form a protein-surfactant complex containing Cd. This Cd containing complex was formed most readily in the pH range 7-9. AS

2

[The effects of cadmium on hens. III. Long term effects on feed consumption, weight gain, laying performance and shell quality.]

Die Wirkung von Cadmiumgaben auf das Huhn. III. Mitteilung: Langzeiteinfluss von Cadmium auf Futterverzehr, Gewichtszunahme, Legeleistung und Eischalenqualität bei Legehennen.

Sülz, M.; Hardebeck, H.; Krampitz, G.

Archiv für Geflügelkunde 38 (4) 150-154 (1974) [17 ref. De] [Inst. für Anatomie, Physiol. und Hygiene der Haustiere, 53 Bonn, Katzenburgweg 7-9, Federal Republic of Germany]

A total of 45 HNL laying hens (30 wk old at the start of the experiment) were used in a 6 month feeding trial to evaluate the effects of dietary Cd (0, 3 or 61 ppm) on the shell quality of eggs. Samples of eggs were collected at 4-wk intervals, and the shell thickness, elasticity and breaking strength were determined. The shell surface was also examined by scanning electron microscopy, and egg shell proteins were isolated by chromatography. The results showed no significant effect of dietary Cd on the thickness, elasticity, breaking strength or ultrastructure of the shell. An additional protein fraction (possibly a glycoprotein) was, however, detected in the shells of eggs laid by Cd-treated hens. [See *Archiv für Geflügelkunde* (1974) 38 (3) 100-103 for part II.] AJDW

3

The interdependence between high cadmium content of horse kidney cortex and the false positive kidney test for the detection of antibiotic

The health hazard resulting from increasing levels of contamination of the environment (especially foods) with Pb, Hg and Cd is discussed with reference to: the need for further studies on metabolism of heavy compounds; the toxicity of methylmercury compounds; and accumulation of Cd in the kidney. IN

6

[Lead and cadmium contents of fruit juices and grape musts.] Blei- und Cadmiumgehalte von Fruchtsäften und Traubenmosten.

Wallrauch, S.

Flüssiges Obst 41 (4) 134-135 (1974) [6 ref. De]

[Landesuntersuchungsamt für das Gesundheitswesen Nordbayern, Chem. Untersuchungsanstalt, Würzburg, Federal Republic of Germany]

Lead and cadmium contents were determined by flameless atomic absorption in a large number of bottled and canned orange juices, apple juices, sweet cherry-musts, grape juices, and also grape musts of increasing Oechsle value. Results showed that the max. permitted levels for fruit juices of 0.3 ppm lead and 0.05 ppm cadmium were exceeded in none of the tests. Highest lead contents occurred in canned orange juice (0.17 ppm). Cadmium levels were well under the limits in trade products, but relatively close to the limits in some grape musts. Increases with increasing Oechsle values were absent or not significant. MJD

7

[Trace-element composition of the Caspian basin fish fauna.]

Patin, S. A.; Morozov, N. P.; Nikonenko, E. M.; Bakunov, N. A.; Fedotova, L. V.

Trudy Vsesoyuznogo Nauchno-issledovatel'skogo Instituta Morskogo Rybnogo Khozyaistva i Okeanografii 100, 40-44 (1974) [5 ref. Ru, en] [Vses. Nauchno-issled. Inst. Morskogo Rybnogo Khozyaistva i Okeanografii, Moscow, USSR]

Contents of Zn, Fe, Sr, Mn, Ni, Pb, Cr, Cu, Co and Cd determined by atomic absorption spectrophotometry are graphically presented for (i) 11 spp. of fresh-water fish and (ii) 12 spp. of sea and anadromous fishes from the Caspian basin. Mean contents with SEM are tabulated for (i) and (ii). The mean values, in the order of elements listed above were respectively (mg/kg fish): 20.6 and 16.2, 5.6 and 10.0 ($P = 0.05$) 6.2 and 5.7, 2.2 and 1.2 ($P = 0.05$), 1.9 and 1.6, 1.7 and 1.1, 1.3 and 1.2, 0.6 and 1.6 ($P = 0.05$), 1.0 and 1.4 and 0.4 and 0.3. Correlation coeff. between contents of some of the elements and of ash are listed. SKK

8

[Heavy metals in commercial fishes of the southern Atlantic.]

Morozov, N. P.; Tikhomirova, A. A.; Tkachenko, V. N.

Trudy Vsesoyuznogo Nauchno-issledovatel'skogo

Instituta Morskogo Rybnogo Khozyaistva i Okeanografii 100, 45-50 (1974) [2 ref. Ru, en] [Vses. Nauchno-issled. Inst. Morskogo Rybnogo Khozyaistva i Okeanografii, Moscow, USSR]

Contents of Zn, Fe, Sr, Cu, Pb, Cr, Mn, Ni, Co and Cd determined by atomic absorption spectrophotometry in muscle, skin, skeleton, gills, fins and scales of sea bream, *Micromesistius poutassu*, horse mackerel, 'Magellani', hake, tunny, 'Gorbyl' and shark are graphically presented. The fish were caught during the 1965 voyage of the research ship 'Akademik Knipovich' in the southern (including the Antarctic) sector of the Atlantic. Data on ash contents are also presented. SKK

9

[Heavy metals in waters and fish of the Baltic basin.]

Morozov, N. P.; Demina, L. L.; Sokolova, L. M.; Prokhorycheva, N. P.

Trudy Vsesoyuznogo Nauchno-issledovatel'skogo Instituta Morskogo Rybnogo Khozyaistva i Okeanografii 100, 32-36 (1974) [5 ref. Ru, en] [Vses. Nauchno-issled. Inst. Morskogo Rybnogo Khozyaistva i Okeanografii, Moscow, USSR]

Contents of Fe, Zn, Ni, Cr, Sr, Cu, Pb, Mn, Co and Cd determined by atomic absorption spectrophotometry are tabulated for muscles of kilka, Baltic herring (2 locations), roach and bream and for whole kilka and sprat from the Baltic basin. Conc. of the metals studied decreased in the order listed above and were, in general, 100-1000 \times higher than in the corresponding sea water. SKK

10

[Factors influencing the toxicity of heavy metals in food.] [Review]

Huisinigh, D.; Huisinigh, J.

Ecology of Food and Nutrition 3 (4) 263-272 (1974) [many ref. En] [St. Univ., Raleigh, N. Carolina, USA]

The following factors influencing the tolerance for heavy metals in food are discussed: the form of the metal; metabolic defence mechanisms; interactions with other elements; the stage of development of the organism and its health status in relation to susceptibility to heavy metals; and effects of the use of heavy metals in agriculture and food processing on concn. in food. The provisional tolerable weekly intake of Cd, Hg and Pb is discussed in relation to current levels. The establishment of a standardized international food monitoring network is proposed. RM

11

[Heavy metals in cereals and cereal products.]

Schwermetalle in Getreide und Getreideerzeugnissen.

Ocker, H.-D.; Nierle, W.

Getreide, Mehl und Brot 28 (11) 285-288 (1974)
[5 ref. De]

Studies on the heavy metal (Hg, Pb and Cd) content of cereals and cereal products are discussed. Tables and graphs of values are given for the heavy metal content of samples of wheat and rye grown in the Federal Republic of Germany, imported samples of rice, durum wheat and durum wheat products and oats and oat products. Heavy metal concn. were within acceptable limits except for some samples of rice which contained ≥ 100 ppb Hg. Studies were also conducted on separation of heavy metals by dry husking; results for wheat showed that Pb concn. can be reduced by 75%, Hg concn. by 50%, and Cd concn. by only 10-20%. Considerable decontamination (with accumulation of heavy metals in the bran) also occurs during milling. Selective absorption of heavy metals by rice gluten was observed. AJDW

12

The lead and cadmium content of milk from industrial areas of England and Wales.

[Conference proceedings]

Harding, F.; Morris, J. L.; Coates, P. J.

XIX International Dairy Congress 1E, 580-581 (1974) [2 ref. En] [Milk Marketing Board, Thames Ditton, UK]

Of 193 milk samples taken monthly between Aug. 1972 and July 1973 from farms or dairies, mainly near industrial areas throughout England and Wales, the % containing <0.02 , 0.02 , 0.03 , 0.04 , 0.05 , 0.06 , and 0.07 ppm Pb respectively was 44.7, 23.3, 21.2, 4.1, 3.6, 2.6 and 0.5. Of 154 samples tested for Cd, 40.9, 26.7, 13.7, 6.5, 3.2, 8.4 and 0.6% contained respectively ($\times 10^{-3}$) <1 , 1, 2, 3, 4, 5 and 6 ppm Cd. DMK

13

Cadmium-109 and methyl mercury-203 metabolism, tissue distribution, and secretion into milk of cows.

Neathery, M. W.; Miller, W. J.; Gentry, R. P.; Stake, P. E.; Blackmon, D. M.

Journal of Dairy Science 57 (10) 1177-1183 (1974) [31 ref. En] [Dept. of Dairy Sci., Med., and Surgery, Univ. of Georgia, Athens, Georgia 30602, USA]

Groups of 3 lactating Jersey cows were given single oral doses of either $^{109}\text{CdCl}_2$ or $\text{CH}_3^{203}\text{HgCl}$. Max. excretion via the faeces occurred on the 2nd day (27.1% of the ^{109}Cd and 13.3% of the ^{203}Hg). Total retention of Hg and Cd after 14 days was 59 and 0.75% respectively. Only 0.17% of the ^{203}Hg appeared in the milk during the 14 days after dosing. The highest level (0.024% of the dose) was present on the 3rd day. Levels of ^{109}Cd in milk were below the detectable limit of 0.00008% of the dose/day. 72% of the total body ^{203}Hg was in the muscle and 7% in the liver.

MEG

14

The fate of toxic elements in aquatic systems. (In "Isotope tracer studies of chemical residues in food and the agricultural environment".) [Conference proceedings]

Rissanen, K. (Food & Agriculture Organization; International Atomic Energy Agency)
pp. 113-118 (1974) [16 ref. En] Vienna, Austria; International Atomic Energy Agency [Dept. of Radiochem., Univ. of Helsinki, Helsinki, Finland]

Recent work using nuclear techniques is summarized on the methylation of Hg in bottom mud and soil, on the metabolism and toxicity to rainbow trout of Hg, Cd and Cu and on the kinetics of Cd elimination from the human body. The biological half-life of methylmercury in fish was longer than that of ethyl- and propylmercury. It was subject to species differences and dependent on methylmercury concn. as well as on temp. AS

15

Atomic absorption analysis of heavy metals in factory water and granulated sugar.

Lew, R. B.

Journal of the American Society of Sugar Beet Technologists 17 (2) 144-153 (1972) [17 ref. En] [Amstar Corp., Spreckels Sugar Div., Woodland, California, USA]

Analytical methods for the analysis of a number of heavy metals, sensitive to submicrogram quantities, in factory water and granulated sugar by atomic absorption spectroscopy have been developed. The method for determining Cd, Cr, Cu, Fe, Pb, Mn, and Zn is based on concentrating the water by evaporation and the sugar by sulphated ashing, with subsequent detn. by standard atomic absorption technique. The detn. of Hg involves wet oxidation, reduction of ionic Hg^{2+} to its atomic state, followed by flameless atomic absorption measurement. The As detn. is based on wet oxidation of the sample, conversion of As^{3+} to AsH_3 , and introduction of AsH_3 into an argon-hydrogen entrained air flame with subsequent quantification by atomic absorption. Limits of detection (corrected for dilution) ranged from 0.02 ppm of As (in sugar, 0.003 in water) to 0.0008 ppm for Zn. AS

16

A numerical study of the concentration of some heavy metals in Tasmanian oysters.

Ratrowsky, D. A.; Thrower, S. J.; Eustace, I. J.; Olley, J.

Journal of the Fisheries Research Board of Canada 31 (7) 1165-1171 (1974) [11 ref. En, fr] [Div. of Mathematical Statistics, CSIRO, Tasmanian Regional Lab., Hobart, Tasmania 7000, Australia]

Inferential techniques of numerical classification and principal coordinate analysis have been used to interpret data obtained on the Zn, Cd, and Cu concn. of 48 samples of oysters, comprising 473 individuals, grown at a variety of places around the

Tasmanian coastline. A close association was obtained between proximity to heavily urbanized areas and concn. of metals found, oysters growing nearest urban areas having the highest concn. of one or more of the metals. It appears that areas for commercial oyster growing should be sought in regions far from centres of urbanization and industrialization. Examination of samples of native oysters could be useful in providing an index or measure of environmental pollution. AS

17

Improved temperature control of a Technicon continuous digester.

Jackson, C. J.; Morley, F.; Porter, D. G.

Laboratory Practice 24 (1) 23-25 (1975) [En]

[Lab. of Govt. Chemist, Cornwall House, Stamford St., London SE1 9NQ]

A simple method for improving the temp. control of a Technicon AutoAnalyzer Digester, used as part of an automatic system for determination of trace metals in foodstuffs, was achieved by substituting proportional heating controllers for the system supplied, thus improving reliability and versatility. AL

18

[Release of cadmium and lead from enamels and pigments. Studies on enamelled utensils and drinking glasses.] Die Abgabe von Cadmium und Blei aus Emails und Schmelzfarben.

Untersuchungen an Emailgeschirr und Trinkgefäßen aus Glas.

Dömling, H.-J.

Deutsche Lebensmittel-Rundschau 70 (12) 439-442 (1974) [15 ref. De, en, fr]

[Landesuntersuchungsamt für das Gesundheitswesen Nordbayern, Erlangen, Federal Republic of Germany]

Release of Pb and Cd from (i) the inside of the lid of enamelled cooking utensils and (ii) decorated drinking glasses was studied. Heavy metal release from (i) was evaluated by boiling a 4% acetic acid solution in the container for 2 h, then leaving it to stand for a further 22 h. Pb and Cd concn. were determined by atomic absorption spectrophotometry. No Cd was released by white, blue or grey-enamelled lids; orange and red-enamelled lids released up to approx. 1.9 mg Cd/dm². (ii) were tested by standing the glass inverted in a 4% acetic acid solution for 24 h at room temp., the upper 2 cm of the glass being immersed. Cd release was ≤ 30 mg/dm²; Pb release was ≤ 300 mg/dm². Recommendations for minimization of the health hazard from Pb- and Cd-containing glazes are given. AJDW

19

[The concentrations of mercury, cadmium, lead and copper in fish and shellfish of Korea.]

Won, J. H.

Bulletin of the Korean Fisheries Society 6 (1/2) 1-19 (1973) [17 ref. Ko, en] [Pusan Fisheries Coll., Pusan, Korea]

Heavy metal concn. were determined in fishes and shellfishes sampled from Oct. 1971 to Apr. 1972 in Korea. In general, fish viscera, shellfish muscle and crustacean exoskeleton contained high concn. of the metals. Samples from the west coast of Korea contained relatively high concn. of Hg, Cu, Cd and Pb, but those from the south coast contained high levels of Cd and Pb. In particular, the concn. of Cu in samples from the west coast were almost double those of other areas. Concn. of Hg as a whole ranged 0.02-0.58 ppm with an average of 0.16 ppm. Concn. of Cd were higher in fish viscera and shellfish than muscle, ranging between <0.02 and 0.78 ppm as compared with an average of 0.12 ppm in fish and shellfish muscle. Pb concn. were fairly high in fish viscera and ranged between 0.06 and 4.84 ppm as compared with an average of 1 ppm in muscle and bone of fish and shellfish. Cu concn. were very high in the viscera of fish and shellfish and ranged between 0.12 and 28.7 ppm. Mean values in fish muscle and shellfish muscle were 1.4 and 5.9 ppm respectively. KoSFoST

20

Radioactive zinc (⁶⁵Zn), zinc, cadmium, and mercury in the Pacific hake, *Merluccius productus* (Ayres), off the west coast of the United States. Naidu, J. R.

Dissertation Abstracts International, B 35 (4) 1820-1821: Order No. 74-23 449 (1974) [En] [Oregon St. Univ., Corvallis, Oregon 97331, USA]

Pacific hake was used to monitor the coastal waters of the west coast of the USA. Zn and Cd concn. increased with fish size, approaching an asymptotic value at maturity. Hg concn. was linear and continued to accumulate with age. AL

21

Cadmium content in meat, liver and kidney of slaughtering pigs. [Conference proceedings]

Kreuzer, W.; Wissmath, P.; Hollwich, W.

IV International Congress of Food Science and Technology Abstracts of Papers 9a, 212 (1974) [En] [Veterinärstrasse 13, 9 München 22, Bayern, Federal Republic of Germany]

Since 1973 the contents of Cd have been determined in the liver, kidney and meat of pigs slaughtered in the Federal Republic of Germany. Close correlation was observed between the 3 Cd levels, with quantities declining in the order kidney > liver > meat. Cd contamination was highest in animals of high deadweight and was higher in pigs than in cows examined at the same time. The legal limits (organs 0.5 ppm, meat 0.1 ppm) were exceeded in some cases. ELC

22

Determination of trace metals in foods using chelating ion exchange concentration.

Baetz, R. A.; Kenner, C. T.

Journal of Agricultural and Food Chemistry **23** (1) 41-45 (1975) [25 ref. En] [FDA, Dallas District, Dallas, Texas 75204, USA]

An improved procedure based on the Baetz and Kenner multimetal method [see FSTA (1973) 5 12A536] which eliminates the necessity for the separate analysis of the neutralization precipitate is reported. The sample is digested in $\text{HNO}_3\text{-H}_2\text{SO}_4\text{-H}_2\text{O}_2$ catalysed by V_2O_5 and the Pb is coprecipitated with added Sr, filtered, converted to carbonate, dissolved, and determined before neutralization of the digest and column separation of the other metals. Cd, Cu, Co, Mn, Ni and Zn are eluted from the column with $2\text{N H}_2\text{SO}_4$ and determined by atomic absorption. Sensitivity varies from 0.01 ppm for Cd to 0.1 ppm for Co and recoveries of added standards to 8 food commodities averaged 97.2%. Co recoveries are lower for certain types of foods. Values obtained by the proposed method on NBS standards 1571 (orchard leaves) and 1577 (bovine liver) agreed with the accepted correct concentrations. The heavy metal content of tomato catsup, fresh spinach, canned Bonito, apples, shredded wheat, homogenized milk, canned turnip, greens and frozen cod fillets was determined. AS

23

[Effects of environmental chemicals, especially heavy metals, on the quality of food and feed plants.] Beeinträchtigung der Qualität von Nahrungs- und Futterpflanzen durch Umweltchemikalien, insbesondere durch Schwermetalle.

Kloke, A.

Qualitas Plantarum - Plant Foods for Human Nutrition **24** (1/2) 137-157 (1974) [many ref. De, en, fr] [Biol. Bundesanstalt für Land- und Forstwirtschaft, Inst. für nichtparasitäre Pflanzenkrankheiten, Königin-Luise-Str. 19, 1 Berlin (West) 33]

Aspects considered in this discussion of the effects of environmental contaminants on the quality of edible plants include: distribution of contaminants in the air; effect of environmental chemicals (e.g. SO_2 , F, nitrogen oxides) on the yield, appearance and composition of food plants; and contamination of food plants with Pb, Hg and Cd (with special reference to sources of contamination and possible health hazards).

AJDW

24

Heavy metals in food products from corn.

Garcia, W. J.; Blessin, C. W.; Inglett, G. E.

Cereal Chemistry **51** (6) 779-787 (1974) [7 ref. En] [N. Regional Res. Lab., Peoria, Illinois 61604, USA]

Concn. of 7 heavy metals (Zn, Mn, Cu, Pb, Cd, Cr and Hg) were determined for a wide variety of consumer-oriented corn products: milled fractions, prepared breakfast and snack foods, canned and frozen sweet corn items, syrups, oil, and kernel popcorn. Samples were decomposed by wet-oxidation, and 6 of the elements were determined by flame atomic absorption. Hg was measured by a nonflame atomic absorption technique. Metal content ranged from $>200 \mu\text{g/g}$ for Zn in a defatted corn germ flour to $<0.001 \mu\text{g/g}$ for Hg in some products. The possible introduction of heavy metals into finished corn products by industrial processing was studied by comparing concn. in finished products with previously determined heavy metal concn. in whole kernel corn. AS

25

Heavy metals in whole kernel dent corn determined by atomic absorption.

Garcia, W. J.; Blessin, C. W.; Inglett, G. E.

Cereal Chemistry **51** (6) 788-797 (1974) [18 ref. En] [N. Regional Res. Lab., Peoria, Illinois 61604, USA]

Whole kernel corn was wet-ashed with nitric and perchloric acids, and the resultant salts were dissolved in dilute acid. Concn. levels in corn samples were determined for Zn, Mn, Cu, Pb, Cd and Cr by flame atomic absorption. To measure the small quantities of Hg present, an oxidation procedure was developed that decomposed organic material in corn at a temp. of 70°C . The Hg was retained effectively in an aqua regia solution until the elemental Hg was de-emanated for measurement of the vapour by a nonflame atomic absorption technique. The aqua regia solution ensured that Hg was completely solubilized. In addition, Hg standards prepared in a 10% aqua regia media have proved to be stable at low concn. for extended periods. Mean concn. values for the 7 metals studied in 11 different corn samples ranged from $23 \mu\text{g/g}$ for Zn to approx. $0.0024 \mu\text{g/g}$ for Hg. AS

26

[Contents of heavy metals in foods. III. Heavy metals in fish and shellfish.]

Tanaka, Y.; Ikebe, K.; Tanaka, R.; Kunita, N.

Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] **15** (5) 390-393 (1974) [6 ref. Ja] [Osaka Prefectural Inst. of Public Health, 3-69, Nakamichi 1-chome, Higashinari-ku, Osaka, Japan]

Cd, Zn, Mn, Cu, Pb, As and total Hg were determined in a total of 105 samples representing 35 spp. of fish, crustacea and molluscs. Tables of results are given. Max. values recorded for each heavy metal were: Cd <1 ppm in all samples; Zn

272 ppm (in oysters); Mn 5.4 ppm (in shellfish); Cu 15.8 ppm (in oysters); Pb <1 ppm in all samples; As 20 ppm (sea eel); and total Hg 1.36 ppm (tunas). [See FSTA (1974) 6 9A381 for part I.] TM

27

[Quantitative determination of trace metals in frozen fish, fish oil and fish meal.] Quantitative Bestimmung von Metallspuren in Frostfisch, Fischöl und Fischmehl.

Bugdahl, V.; Jan, E. von

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 157 (3) 133-140 (1975) [5 ref. De, en] [Unilever Forschungsgesellschaft mbH, D-2000 Hamburg 50, Federal Republic of Germany]

73 duplicate samples of the most common fish var. eaten in Federal Germany (cod, herring, red fish, saithe and tuna, caught between Dec. 1972 and Sept. 1973), 2 samples of fish oil and 2 of fish meal were analysed for contents of As (photometry), Cd and Pb (anodic stripping voltammetry) and Hg (flameless AAS). Mean contents found (ppm) for the 5 var. of fish were As 0.84, Cd 0.003, Pb 0.08 and Hg 0.06. Proposed legal max. for the metals were reached only for As (18% of the samples containing ≥ 0.5 ppm, the proposed limit); it is suggested that this limit for As should be raised. No correlation between fishing ground and metal content of the fish could be established. The contents of the metals found in the oil and meal showed that processing of the fish had led to no increase in the metal concn. HBr

28

Trace metal analysis of foods by non-flame atomic absorption spectroscopy.

Culver, B. R.; Lech, J. F.; Pradhan, N. K.

Food Technology 29 (3) 16, 18, 20-21, 25 (1975) [10 ref. En] [Varian Instrument Div., 611 Hansen Way, Palo Alto, California 94303, USA]

This article discusses 3 types of sample pretreatment technique applicable to non-flame atomic absorption spectroscopy for the analysis of trace metals in foods. The techniques are acid hydrolysis, wet ashing with a sulphuric acid-hydrogen peroxide mixture, and dry ashing. A carbon rod atomizer is used as the non-flame atomization source. IFT

29

[The effect of Zn, Cd and Hg salts on the growth of lactic acid bacteria.]

Savel, J.; Prokopova, M.

Kvasny Prumysl 20 (12) 265-267 (1974) [7 ref. Cs, ru, en, de] [Jihoceske Pivovary, Ceske Budejovice, Czechoslovakia]

Growth inhibition of 8 strains of lactobacilli and 7 of pediococci (4 and 1 collection strains respectively and the rest from beer) was in the order $Hg \geq Cd > Zn$; Cd and Zn salts were more inhibitory to pediococci than to lactobacilli. Min. inhibitory concn. (MIC) of $CdCl_2 \cdot 2.5H_2O$ in fermented wort agar was 200-1400 mg/l. for lactobacilli and 1.6-200 mg/l. for pediococci;

corresponding MIC of $ZnCl_2$ were 6400-12 800 and 400-6400 mg/l., and of $ZnSO_4 \cdot 7H_2O$ were 12 800-25 600 and 800-25 600 mg/l. The Hg salts suppressed growth of lactobacilli to the same extent as that of pediococci. [From En summ.] STI

30

Metals and foods.

Whitman, W. E.

Food Progress 2 (11) 1-2 (1975) [En]

Interactions between structural materials used in food manufacturing plants, foodstuffs and cleansing agents, and the likelihood of their causing food poisoning or food off-flavours are discussed. As, Pb, Hg, Cd and Zn may cause food poisoning, whilst metals such as Cu (even at 0.1 ppm), Ni, Fe and Cr may catalyse oxidation reactions and cause off-flavours. Al is suitable for use in food plant construction, but not for long-term storage of acid products. CDP

31

An appraisal of toxic metal residue in the soils of a disused sewage farm.

Pike, E. R.; Graham, L. C.; Fogden, M. W.

Journal of the Association of Public Analysts 13 (1) 19-33 (1975) [21 ref. En] [County of Leicester Public Analyst's Lab., Fillingate, Wanlip, Leicester, UK]

The toxic metals (Zn, Cu, Ni, Pb, Cd, As and Cr) in the soils of disused sewage farm were determined and consideration given to any toxic hazard likely to be encountered during the building of a proposed satellite town on the site. Uptake of the Zn, Cu and Ni by vegetables (lettuce, radishes, cabbages, savoy, cauliflowers, potatoes, carrots, sprouts, tomatoes and beans) grown on the sewage farm soil was investigated. Results were: Zn - all vegetables satisfied the usually accepted max. Zn content of 50 ppm, but lettuce and radish tended to accumulate Zn when grown in soils of high Zn content; Cu - level in the vegetables did not approach the max. level of 20 ppm and there was no preferential uptake on Cu-rich soils; and Ni - no vegetable exceeded the 50 ppm level suggested by Monier-Williams. VJG

32

The uptake and distribution of cadmium in selected grain and vegetable crops.

Peel, J. W.

Dissertation Abstracts International, B 35 (6) 2805: Order No. 74-26760 (1974) [En] [Purdue Univ., Lafayette, Indiana, USA]

The uptake and distribution of Cd in corn, soybeans, tomatoes, carrots and spinach were studied, and the possible inhibitory properties of Zn on uptake of Cd were evaluated. In greenhouse studies, Cd was taken up by all the plants growing in soil containing 3 ppm Cd as $CdCl_2$ with 10 μCi of ^{115}Cd added/lb soil. Foliar application of ^{109}Cd

as soluble acetate to corn plants 37 days after planting and sampled 24, 48, 72, 96 and 120 h later revealed the uptake and distribution of Cd with time. Field trials with 0.5 or 5 ppm Cd and 0 or 100 ppm Zn revealed no significant differences in Cd content of corn at the milk and dent stages, and indicated that soil treatment with Zn might enhance Cd uptake. Also studied were the uptake and distribution of Cd and Zn in corn grown on soil containing 3 ppm CdCl₂, or treated at 23-103 days after planting and harvested 5 days later. Zn levels for corn were generally higher when the plants had been treated with Cd. AL

33

The concentration of mercury, copper, nickel, silver, cadmium, and lead in the northern Adriatic anchovy, *Engraulis encrasicolus*, and sardine, *Sardina pilchardus*.

Gilmartin, M.; Revelante, N.

Fishery Bulletin, National Oceanic and Atmospheric Administration 73 (1) 193-201 (1975) [37 ref. En] [Australian Inst. of Marine Sci., PO Box 1104, Townsville, Queensland 4810, Australia]

Levels of Hg, Cu, Ni, Ag, Cd and Pb were determined in various tissues of the northern Adriatic anchovy, *Engraulis encrasicolus*, and sardine, *Sardina pilchardus*, throughout a 7 month fishing season. The highest concn. of Ni, Ag, Cd and Pb occurred in the skin and gills, with little interspecific difference and no unusually high values. The highest concn. of Hg and Cu occurred in internal tissues, with the anchovy showing markedly higher concn. than the sardine. Total Hg concn. in anchovy muscle were 70-215 ng/g wet wt., 2-4 times greater than in the same or similar anchovy spp. of northwestern Africa, southeastern USA and California. AS

34

[Cadmium in the meat and organs of fatstock.]

Cadmium in Fleisch und Organen von Schlachttieren. Kreuzer, W.; Sansoni, B.; Kracke, W.; Wissmath, P. *Fleischwirtschaft* 55 (3) 387-396 (1975) [92 ref. De, en, fr] [Bereich Hygiene und Tech. der Lebensmittel tierischen Ursprungs, Univ., 8000 Munich 22, Veterinärstrasse 13, Federal Republic of Germany]

A total of 150 cattle of various ages (1.5-6 yr), breeds, and origins (141 from an agricultural area, 9 from an industrial area) were used in studies on the Cd content of muscle tissue and viscera. 100 g samples of adductor muscle, liver and kidney tissue were taken from all 150 animals; samples of spleen tissue were taken from 6 animals. Cd concn. were determined by flameless atomic absorption. All muscle samples contained <0.005 ppm Cd. Ranges of values for the Cd concn. in liver, kidney and spleen were, respectively (ppm): 0.005-0.30; 0.04-1.66; and 0.006-0.2. Cd concn. in the liver and kidneys increased with increasing age of the animal;

the correlation coeff. between age and Cd concn. in the kidneys and the liver were 0.47 and 0.41 respectively. A tolerance of 0.5 ppm in kidneys is recommended. RM

35

[Emissions and food quality.] Immissionen und Nahrungsqualität. [Lecture]

Vetter, H.; Früchtenicht, K.; Mählehop, R.

Landwirtschaftliche Forschung 30 (Sonderheft I) 29-39 (1973) [De] [Mars-la-Tour-Strasse 4, 29 Oldenburg, Federal Republic of Germany]

Concn. of toxic components from air pollution in soils and plant and animal foods was investigated. 300 samples of food were analysed for Zn, Pb, Cu and Cd as follows: 12 kinds of fruits and vegetables up to 3 km from the source of emission, cereals up to 15 km, fish up to 7.5 km, meat and milk up to 15 km. Mean Zn concn. of all foods were 40% higher than normal and Cu concn. were reduced, probably through competition by Cd during absorption. At 2 km, mean Cd concn. increased 7-fold, Pb concn. 11-fold, especially in liver (19-fold) and kidney (25-fold), less in milk (3-fold) and meat (5-fold). RM

36

[Investigation of harmful trace elements in food.]

Ko, I. S.; Ro, C. B.; Song, C.; Kwon, H. H.; Kim, K. S.; Yun, K. B.; Yoo, B. C.

Report of the National Institute of Health 10, 437-453 (1973) [42 ref. Ko, en] [Coll. of Pharmacy, Kyung Hee Univ., Seoul, Korea]

Trace elements, including Cu, Pb, Cd, Mn and Zn were determined in foods collected from various locations in Korea. [See FSTA (1974) 6 3C87 for previous part.] KoSFoST

37

[Cadmium contamination of animal feeds and foods.] Über die Kontamination von Futtermitteln und Nahrungsmitteln mit Cadmium.

Oelschläger, W.

Landwirtschaftliche Forschung 27 (3/4) 247-263 (1974) [50 ref. De, en, fr] [Abteilung Tierernährung, Fachgruppe 9, Univ. Hohenheim, Federal Republic of Germany]

The biological effects of Cd, toxic doses for domestic animals and man, sources of contamination of foods and feeds, and methods of determination are discussed and results of analyses of various foods and feedstuffs tabulated. Results include the following (mean Cd concn. in ppm, DM

basis, product in parentheses refers to highest concn.): roots, tubers and their products, 0.03-0.21 (potato starch); cereals and cereal by-products, 0.005-0.18 (malt germ); oilseeds and by-products, 0.01-0.72 (extracted safflower grits); dried milk and whey, 0.006-0.018; poultry by-products, 0.19; vegetables and foods of animal origin, 0.002-0.633 (edible yeast); and beverages, 0.060-2.10 (condensed milk). Calculated daily and weekly Cd intakes from 72 types of food are lower than WHO recommended tolerances. RM

3 8

[Use of neutron activation and atomic absorption to study certain heavy metals in the fodder-dairy products chain.] (In "Comparative studies of food and environmental contamination. Proceedings of a symposium on nuclear techniques in comparative studies of food and environmental contamination, held in Otaniemi, Finland, 27-31 August, 1973".) [Conference proceedings]

Bruant, C.; Bruant, J.-P.; Neuburger, M.; Fourcy, A.

pp. 293-307 (1974) [8 ref. Fr, en] Vienna, Austria; International Atomic Energy Agency [Centre d'Etudes Nucleaires de Grenoble, France]

Neutron activation methods for the measurement of Cu, Hg and Zn and atomic absorption methods for measuring Pb and Cd were used to estimate these metals in hay, maize, oilcake, feed concentrates, mineral supplements and drinking water given to dairy cows, and in the resulting milk and milk products. Drinking water contained ($\mu\text{g/l.}$): Hg, 0.11-0.63; Cu, 20-600; Zn, 150-1900; Pb, 2.5-23; and Cd, ≤ 1 . The feedstuffs (excluding the mineral supplement) contained ($\mu\text{g/g.}$): Hg, 0.005-0.019; Cu, 4.8-24.5; Zn, 16.1-55.5; Pb, 0.80-4.48; and Cd, 0.29-0.72. Compared with the high metal intake, the output in the milk was low. The milk contained ($\mu\text{g/g non-desiccated crude matter.}$): Hg, 0.0019 ± 0.0011 ; Cu, 0.87 ± 0.30 ; Zn, 5.8 ± 2.6 ; Pb, 0.18 ± 0.20 ; and Cd ($\mu\text{g/g fresh material.}$), 0.08-0.29. During cheesemaking there was a concentration of the metals resulting in the following levels ($\mu\text{g/g.}$) in Camembert and Gruyere cheeses respectively: Hg, 0.054 and 0.063; Cu, 4.68 and 47.16; Zn, 27.7 and 33.2; Cd 0.17-0.50 and 0.18-0.25. Levels of Pb were too low for accurate estimation. The high level of Cu in the Gruyere cheese was due to the use of Cu utensils. MEG

3 9

Potential toxicity of cadmium and zinc in gulf shellfish.

Grondin, S. P.

Dissertation Abstracts International, B 35 (8) 3969-3970: Order no. 75-1928 (1975) [En] [Louisiana St. Univ., Baton Rouge, Louisiana 70803, USA]

Cd and Zn were determined in 60 samples each of oysters and shrimps and in 96 samples each of water and bottom sediment from 6 locations on the lower Mississippi and 2 bays on the Gulf of Mexico. It was found that oysters contained about 7% more Zn when harvested early in the year than when

harvested late in the year, but place of collection did not significantly affect Zn content. Cd and Zn contents of shrimp were not significantly affected by time or place of collection. Bay oysters contained about 30% more Zn than shrimps, Zn and Cd contents of oysters and shrimps from the 2 bays were similar, although the environmental variables of the bays were significantly different. AL

4 0

The levels of heavy metals (Mn, Fe, Co, Ni, Cu, Zn, Cd, Pb, Hg) in fish from onshore and offshore waters of the German Bight.

Harms, U.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 157 (3) 125-132 (1975) [12 ref. En, de] [Bundesforschungsanstalt für Fischerei, Hamburg, Federal Republic of Germany]

During the period Oct. 1972-March 1974, muscle samples from cod and plaice caught in different regions of the German Bight were analysed for heavy metals using atomic absorption spectrophotometry. Each sample consisted of a homogenate of 10 fillets. Details of the methods of analysis are given. The ranges of values found were: Zn, 2.0-7.5 ppm; Fe, 0.3-3.0 ppm; Cu, 0.2-1.0 ppm; Mn, 0.03-0.2 ppm; Co, 5-15 ppb and Ni, 20-100 ppb. No significant differences between the levels of these metals in cod and plaice muscle or in onshore or offshore waters were found. Cd levels in offshore fish were < 20 ppb with 50% of the values between 3 and 8 ppb, whereas plaice from coastal fishing areas (especially in the vicinity of the river Elbe) sometimes contained Cd levels of up to 70 ppb. The Pb and Hg contents of offshore fish muscle were < 0.1 and < 0.14 ppm respectively but plaice from onshore waters contained 0.08-0.2 ppm Pb and up to 0.35 ppm Hg. The results indicate that river pollution is one of the main sources of metals in fish muscle. MEG

4 1

[Studies of lead and cadmium in crockery.]

Untersuchungen über die Blei- und Cadmiumabgabe in Geschirren.

Hegersweiler, P.

Mitteilungen aus dem Gebiete der Lebensmitteluntersuchung und Hygiene 66 (1) 58-63 (1975) [De, fr] [Kantonales Lab., CH-4056 Basel, Switzerland]

Experiments and findings of the [Swiss] Working Party on Pb tolerances for Crockery charged with revision of Article 453 of the Food Regulations are briefly reported. Article 453 demands that those parts of enamelled, lacquered or glazed vessels and crockery liable to come in contact with foods or the mouth of the consumer should not release in 24-h treatment with 4% acetic acid ≥ 3 mg Pb/100 cm^2 surface. The recommendations of the Party on max. contents of Pb and Cd, respectively, in vessels and crockery are (mg/100 cm^2 surface): inside of vessels and topside of plates, 0.5 and 0.05; rim of all drinking vessels coming in contact with lips in a width of ≥ 2 cm, 1.0 and 0.10; and total outer surfaces, 20.0 and 2.0. SKK

42

Simultaneous determination of seven trace metals in potable water using a vidicon atomic absorption spectrometer.

Aldous, K. M.; Mitchell, D. G.; Jackson, K. W. *Analytical Chemistry* 47 (7) 1034-1037 (1975) [12 ref. En] [Div. of Lab. & Res., New York St. Dept. of Health, New Scotland Avenue, Albany, New York 12201, USA]

A multichannel atomic absorption spectrometer was used for the detn. of Zn, Cd, Ni, Co, Fe, Mn, and Cu in potable waters. Metals were chelated with ammonium pyrrolidine dithiocarbamate at pH 4, and a 10-fold concn. achieved by extracting into methyl isobutyl ketone. The organic phase was aspirated into an air-acetylene flame, and atomic absorption measured simultaneously at the resonance lines of these elements by dispersing a 168-nm region of the lamp and flame spectrum across a vidicon array detector. Detection limits of 0.004-0.02 µg/ml have been obtained, with dynamic ranges up to 100 and relative SD of 3% at optimum concn. This performance, though poorer than by conventional single-channel AAS, is adequate for routine monitoring of public water supplies and most waste waters. AS

43

[Cadmium - a health hazard in the human environment.] Cadmium - Ein Schadfaktor in der menschlichen Umwelt. [Review]

Cumbrowski, J.; Raiffe, W.

Zeitschrift für die Gesamte Hygiene und ihre Grenzgebiete 21 (1) 1-7 (1975) [68 ref. De, en, ru] [Hygiene-Inst. des Bereichs Med., Humboldt-Univ., Berlin (GDR)]

Aspects considered in this review include: potential sources of pollution with Cd; the toxicology of Cd; international tolerances for Cd; prevention of chronic Cd poisoning; and detn. of Cd in air, water and food. IN

44

[Determination of heavy metals in foods by inverse polarography. I. Determination of lead, copper and cadmium.] Die Bestimmung von Schwermetallspuren in Lebensmitteln mit Hilfe der Inverspolarographie. I. Die Bestimmung von Blei, Cadmium und Kupfer.

Collet, P.

Deutsche Lebensmittel-Rundschau 71 (7) 249-253 (1975) [6 ref. De, en, fr] [Chem. Untersuchungsamt für das Saarland, Federal Republic of Germany]

A method for detn. of Pb, Cd and Cu in foods by inverse polarography is described; samples are digested by heating with $H_2SO_4 + H_2O_2$ before analysis. Sn interferes with detn. of Pb but may be separated as tin (IV) iodide by heating of the digested sample with NH_4I . Detection limits for the

3 metals studied were (ng/ml): Cu 6; Cd 0.25; and Pb 2.6. Reproducibility studies on model solutions showed SD of 2-10% depending on concn. Data (mean values and ranges) are given for the Pb, Cu and Cd concn. in 298 samples of various foods (meat and meat products, canned foods, alcoholic beverages, fresh vegetables, fresh fruit, cereal products, ice cream and dried soups). AJDW

45

Trace metals and protein in California market milk. [Lecture]

Bruhn, J. C.; Franke, A. A.

Journal of Dairy Science 58 (5) 788 (1975) [En] [Univ. of California, Davis, California, USA]

* In samples of market skim-, low-fat, regular and extra rich milks, mean concn. of Cu, Pb, Cd and Se respectively were (ppm): 0.042 ± 0.02 ; 0.07 ± 0.062 ; 0.054 ± 0.048 ; and 0.024. Mean concn. of Zn in the 4 milk products respectively were 3.9, 4.2, 3.6 and 3.8 ppm, and corresponding protein concn. were 3.7, 3.8, 3.3 and 3.4%. [See 7 11P2324.] DMK

46

Pesticide residues in total diet samples. VII.

Manske, D. D.; Corneliussen, P. E.

Pesticides Monitoring Journal 8 (2) 110-124 (1974) [13 ref. En] [Kansas City Field Office Lab., FDA, US Dept. of Health, Education & Welfare, Kansas City, Missouri 64106, USA]

A total of 360 composite samples of 12 classes of foods (dairy products; meat, fish and poultry; grain and cereal products; potatoes; leafy vegetables; legumes; root vegetables; garden fruit; other fruit; oils, fats and shortenings; sugars and adjuncts; and beverages) collected in 30 markets in 27 cities in the USA during the period June 1970-April 1971 were analysed for a total of 33 toxic substances (pesticides, polychlorinated biphenyls and heavy metals). Detailed tables of results are given, broken down by product type, residue type and region. [See Pesticides Monitoring Journal (1972) 5 (4) 313-330 for part VI.] AJDW

47

[Problems of methylmercury and other biocides.] [Lecture]

Berglund, F.

pp. 217-220 (1974) [5 ref. Sy] [Statens Livsmedelsverk, S-104 01 Stockholm, Sweden]

* Problems of contamination of foods with methylmercury, Cd and polychlorinated biphenyls are discussed, with reference to toxicological aspects, sources of contamination, and the incidence of contamination of foods with these substances. [See 7 12S1671.] AJDW

48

Extraction of heavy metals from plastic food containers: an X-ray fluorescence and atomic absorption study.

Meranger, J. C.; Cunningham, H. M.; Giroux, A. *Canadian Journal of Public Health* 65 (4) 292-296 (1974) [11 ref. En, fr] [Health Protection Branch,

Food Res. Lab., Health & Welfare Canada, Food & Drug Building, Tunney's Pasture, Ottawa, Ontario K1A 0L2, Canada]

X-ray fluorescence scanning of 62 plastics food containers purchased in local supermarkets revealed the presence of the following elements: Ba, Bi, Br, Cd, Cu, Fe, Hg, Ni, Pb, Se, Sr, and Zn. The amount of metal leachable by simulated food solvents was determined by atomic absorption spectrophotometry on all Cd, Hg, and Pb-containing plastics. No extractable Pb levels were found, while Hg was extracted at levels up to $0.02 \mu\text{g}/\text{cm}^2$. Traces of Cd from 0.002 to $0.020 \mu\text{g}/\text{cm}^2$ were found in all but 2 samples. UV irradiation and surface abrasion increased this max. amount to 0.049 and $0.034 \mu\text{g}/\text{cm}^2$ respectively, while scrapings of the same plastics were more soluble ($0.45 \mu\text{g}/\text{cm}^2$). The amount of Cd leached by 0.1 N HCl from these same scrapings ($0.266 \mu\text{g}/\text{cm}^2$) indicated that Cd could be dissolved from the ingestion of small pieces of plastics material. AS

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Reading RG2 9AT, Berkshire, England.

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FAB 37

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H. BROOKES
ASSISTANT EDITOR

Effects of cadmium on the growth and uptake of cadmium by microorganisms.

Doyle, J. J.; Marshall, R. T.; Pfander, W. H. *Applied Microbiology* **29** (4) 562-564 (1975) [14 ref. En] [Dep. of Food Sci. & Anim. Husbandry, Univ. of Missouri, Columbia, Missouri 65201, USA]

Six species of microorganisms, *Escherichia coli*, *Bacillus cereus*, *Lactobacillus acidophilus*, *Staphylococcus aureus*, *Streptococcus faecalis* and *Actinomyces niger*, were studied. Cadmium chloride was added to provide 0, 5, 10, 20, 40, and 80 µg Cd/ml. At 40 and 80 µg Cd/ml, *E. coli* and *B. cereus* grew well whilst the other species were repressed. Cd uptake patterns differed significantly among the species tested. The significance of these data with respect to Cd in food chain is discussed. AS

2

Determination of heavy metals in foods by anodic stripping voltammetry after sample decomposition with sodium and potassium nitrate fusion.

Holak, W.

Journal of the Association of Official Analytical Chemists **58** (4) 777-780 (1975) [6 ref. En] [FDA, 850 Third Avenue, Brooklyn, New York 11232, USA]

A method is described for the simultaneous detn. of several heavy metals in foods. The sample is predigested with HNO_3 and decomposed completely by heating with a mixture of sodium and potassium nitrates. The resultant melt containing the metals is then dissolved in dilute HNO_3 . After the pH is adjusted to an appropriate value, the metals, such as Cd, Cu, Pb, and Zn, are determined by anodic stripping voltammetry. The average recoveries of these metals added to 5 commodities were 98, 98, 96 and 104%, respectively. The relative SD, based on data from analyses of a commodity containing measurable levels of Cu, Pb and Zn, were 12.0, 13.0 and 9.7%, respectively. AS

3

[Cadmium, lead and zinc contents of fruits and vegetables from gardens in an industrial region.]

Cadmium-, Blei und Zinkgehalt pflanzlicher Lebensmittel aus Kleingärten eines Industriegebiets. Pfeilsticker, K.; Markard, C.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung **158** (3) 129-135 (1975) [21 ref. De, en] [Lehrstuhl für Lebensmittelwissenschaft, Univ., Bonn, Federal Republic of Germany]

Cd, Pb and Zn contents of 3 samples of milk obtained in 1973 in Dortmund (Federal Republic of Germany) and of a total of 136 samples of fruit and vegetables from Dortmund gardens were determined by AAS. Methods and procedure are described in detail. Geometric means with ranges (ppm) of milk were 0.024 (0.01-0.076), 0.197 (0.11-0.266) and 6.79 (4.81-10.01), respectively, for Cd, Pb and Zn. Fruit and vegetable samples were from 21 sites in the industrial regions, distances of the

sites from relevant potentially contaminating factories being diagrammatically shown. Values are tabulated as for milk for 2-14 samples each of 12 var. of vegetable and 8 var. of fruit. 5% of all samples exceeded the proposed max. limit of 0.1 ppm for Cd (among them parsley, lettuce, lamb's lettuce and redcurrant samples, max. content of 0.2 ppm being in lamb's lettuce; 13% exceeded the proposed max. limit of 0.8 ppm for Pb (among them rhubarb, lamb's lettuce, redcurrant, blackcurrant and gooseberry samples, max. content of 9.1 ppm being in rhubarb); and 13% exceeded the proposed max. limit of 10 ppm for Zn (among them parsley, lettuce, lamb's lettuce, spinach and gooseberry, max. content of 26.7 ppm being in parsley). SKK

4

Cadmium.

Webb, M.

British Medical Bulletin **31** (3) 246-250 (1975) [32 ref. En] [Med. Res. Council, Toxicology Unit, Carshalton, Surrey, UK]

Aspects considered in this paper on environmental contamination with Cd (with special reference to Cd in foods) include: sources of Cd in the environment; Cd in living organisms; Cd in foods; absorption and elimination of Cd; toxicity of Cd; and significance of the health hazard from Cd-contaminated food. AJDW

5

Cadmium content of soybeans grown in sewage-sludge amended soil.

Jones, R. L.; Hinesly, T. D.; Ziegler, E. L. *Journal of Environmental Quality* **2** (3) 351-353 (1973) [11 ref. En] [Dep. of Agron., Univ. of Illinois, Urbana, Illinois 61801, USA]

Disposal of municipal sludge on cropland raises the question of availability to plants of Cd which is often more conc. in sludges compared to native levels in soil. In a greenhouse experiment, Cd added in a factorial design with heated anaerobically digested sewage sludge and cadmium acetate as factors was readily available to the soybean plant (*Glycine max* L.) where it was translocated to aerial parts, accumulating ≤ 18 ppm in the mature plant. Incremental additions of sewage sludge tended to depress the Cd levels observed in the mature plant and seed. Cd contents in the plant at harvest and in seed were directly related to soil levels extractable by 0.1N HCl. Seed levels of about 1.0 ppm Cd produced by application of 144 t/ha of sludge solids were not within toxic limits reported in the literature. AS

E

The effect of some heavy metals on oats in a pot experiment with three different soil types.

Sorteberg, A.

Journal of the Scientific Agricultural Society of Finland 46 (3) 277-288 (1974) [15 ref. En, fi] [Dept. of Soil Fertility & Management, Agric. Univ. of Norway, Norway]

The effects of 5 heavy metals (Cd, Co, Pb, Hg and Ni) on yield and heavy metal contents of oats were determined. The heavy metals were applied at concn. of (i) 0.5 and (ii) 250 mg/pot combined with liming at each of 2 concn. on clay, peat and sandy soils. Tabulated data are given. Apart from Pb, the heavy metal content of the oats increased with increased metal application. The heavy metal content in crops from peat and sandy soil was greater than in crops grown on clay soil. The Cd, Ni and Co contents were lower with heavy liming than with light liming, particularly in crops from clay and sandy soils. Liming had equivocal effects on Hg and Pb uptake. GL

7

[Charting of lead and cadmium contents of Swedish market milk.]

Jonsson, H.

Nordisk Mejeriindustri 2 (2) 58-59, 61 (1975)

[13 ref. Sv]

Cd content of 98 samples of 3%-fat market milk from 10 dairies in different parts of Sweden (1974) was $<0.2 \mu\text{g/l}$. in all cases. Pb content averaged $2.01 \mu\text{g/l}$. with SD of 0.49. On the basis of daily per caput milk consumption of 0.5 l., it is estimated that weekly intake via milk is $7 \mu\text{g}$ Pb and $<0.7 \mu\text{g}$ Cd, well below the max. recommended by WHO. ADL

8

Distribution and removal of selected heavy metals from milk.

Roh, J. K.

Dissertation Abstracts International, B 35 (10) 4936, Order No. 75-2478 (1975) [En] [Wisconsin Univ., Madison 6, Wisconsin, USA]

Distribution patterns of added Hg to raw whole milk containing 1 ppm Hg and equilibrated for 30 min and 2 h at 37°C showed that Hg distribution in acid casein, whey proteins, fat globule membrane pellet and soluble fat globule membrane was respectively 33, 28, 16 and 2%. In milk containing 1 ppm Cd, equilibrated for 2 and 24 h, 96% of added Cd was associated with the skim-milk fraction and 3% with the cream. Distribution of Cd in acid casein, whey protein and fat globule membrane was 18, 6 and 0.5% of total added Cd respectively. On the basis of protein content, the fat globule membrane contained the highest Hg and Cd. Incubation at 37°C of thiosuccinylated aminoethyl cellulose (TSAEC) and thionitrocarboxyphenylated aminoethyl cellulose (TNPAEC) resins and

reduced human hair with whole milk containing 1 ppm Hg resulted in removal of approx. 71, 44 and 41% respectively of added Hg in 5 min; about 82, 52 and 65% respectively was removed in 60 min. Removal efficiency from milk containing 1 ppm added Cd was 72, 70 and 31% in 5 min with TSAEC, TNPAEC and reduced human hair respectively. The resins had high affinity for Cu; TSAEC removed 90% of added Cu from milk, wine and grape juice. Treatment of milk with the resins did not alter the protein or lactose content or pH. Effects of pH on the efficiency of the resins are described. DMK

9

An investigation of heavy metal contamination of drinking water in the city of Trondheim, Norway.

Stegavik, K.

Bulletin of Environmental Contamination and Toxicology 14 (1) 57-60 (1975) [1 ref. En] [Inst. of Physics, Univ. of Trondheim, 7000 Trondheim, Norway]

A total of approx. 600 samples of (i) cold water stored in the tap for several h, (ii) running cold water, and (iii) hot water from the hot water heater was obtained from houses and flats in Trondheim. The samples were analysed for Zn, Cd, Cu and Pb by flameless atomic absorption spectrophotometry. Taps were found to be the main source of Zn and Cd, and water heaters the main source of Pb. Generally, concn. were very small and constitute no reason for concern regarding public health implications. Mean levels found (parts/billion) in (i), (ii) and (iii), respectively, were: Zn, 348, 126 and 130; Cu, 164, 52 and 209; Pb, 9.7, 2.7 and 21; Cd, no mean levels given. Max. concn. (parts/billion) found were: Zn, 2125; Cd, 8.6; Cu, 1100; and Pb, 110. JRR

10

[The determination of microamounts of cadmium, copper, nickel and manganese in fats and oils by atomic absorption spectrophotometry.]

Noguchi, C.; Hirayama, H.; Shige, T.; Jinbo, M.; Takahashi, T.; Tsuji, K.; Nakasato, S.; Matsubara, S.; Murase, Y.; Murui, T.; Yamashita, T.; Yoshida, J.

Journal of Japan Oil Chemists' Society [Yukagaku] 24 (2) 100-106 (1975) [2 ref. Ja, en] [Nippon Oils & Fats Co. Ltd. 1-10-1, Yurakucho, Chiyoda-ku, Tokyo, Japan]

A rapid and precise method for the determination of microamounts of Cd, Cu, Ni and Mn in fats and oils was studied. The samples were decomposed by wet-digestion with H_2SO_4 and H_2O_2 (30%). Cd and other metals in the decomposed solution were extracted into methyl isobutyl ketone as complexes with sodium diethyldithiocarbamate. The extracts were directly atomized into the air-acetylene flame, and absorbances measured at 228.8 nm for Cd, 324.7 nm for Cu, 232.0 nm for Ni and 279.5 nm for Mn. The most suitable pH for extraction was 7, and the

metals were quantitatively extracted into methyl isobutyl ketone by 1 extraction. 97.6-101.7% recoveries were obtained in a study on the effect of coexisting metals. The proposed method was evaluated with respect to recovery and reproducibility by collaborative studies on samples prepared by adding known amounts to soybean oil. The results showed good agreement with theoretical values and satisfactory reproducibility. From soybean oil (Cd, Cu, Ni, Mn respectively) results were: % recovery, 101.9, 100.0, 104.0, 103.6; SD, 0.03, 0.04, 0.27, 0.15; and coeff. of variation (CV) 1.7, 1.6, 5.2, 2.9%. From 4 collaborative studies (all 4 metals) results were: % recoveries, 92.0-104.0; SD, 0.05-0.76; and CV, 2.9-19.9%. RM

11

And last, but not least, cadmium.

Grasso, P.

Food and Cosmetics Toxicology 13 (4) 470-472 (1975) [13 ref. En] [British Ind. Biol. Res. Ass., Woodmansterne Road, Carshalton, Surrey, UK]

Prolonged ingestion of Cd can result in the Japanese 'itai-itai' disease. Aspects considered are: morphological studies of the kidney; electron-microscopic studies; tests of renal function; and biochemical investigations. [See preceding abstr.] VJG

12

[Lead and cadmium migration from Porcelite table ware into a model liquid.]

Zawadzka, T.; Brzozowska, B.

Roczniki Państwowego Zakładu Higieny 26 (4) 483-488 (1975) [8 ref. Pl, ru, en] [Państwowy Zakład Higieny, Warsaw, Poland]

Porcelite [? porcelain-glazed] green, yellow and brown cups, yellow and brown plates (dessert, dinner, soup), green sugar bowls, and brown teapots were examined. 5 pieces of each type of crockery were washed, dried, filled with 4% acetic acid solution, allowed to stand for 24 h at 20°C, and the contents were evaporated to dryness and analysed for Pb and Cd; the pieces were filled again with the acid solution and the procedure was repeated. Individual and mean values are tabulated for the 1st and 2nd migrations. Ranges of mean values were (mg/l.): Pb, 1st migration 0.0019 (yellow cup) - 0.0316 (green sugar bowl), 2nd migration 0 (yellow and brown cups) - 0.0022 (brown soup plate); Cd, 1st migration 0.00014 (yellow dinner plates with brown decoration) - 0.0009 (green sugar bowl), 2nd migration 0 (yellow dessert plates with brown decoration) - 0.0001 (green cup and green sugar bowl). The values found were below the official tolerance limits. SKK

13

[Determination of some metals in drinking water by flameless atomic absorption spectrophotometry.]

Ooghe, W.; Kastelijn, H.

Annales des Falsifications et de l'Expertise Chimique 68 (728) 201-211 (1975) [14 ref. Fr] [Lab. de Bromatologie, Inst. de Pharmacie, 135 De Pintelaan, B-9000 Ghent, Belgium]

The metal contents of 15 commercially-bottled mineral waters and of 15 Belgian drinking waters were measured using 50 µl samples analysed in a Perkin-Elmer atomic absorption spectrophotometer equipped with an HGA-72 graphite oven and a deuterium background corrector. Optimal instrument conditions for determining Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Sn and Zn are described. The metal concn. (in µg/l.) in the mineral and drinking waters respectively were: Cd, <0.1-2.7 and <0.1-0.3; Co, <1 and <1; Cr, <1-2.5 and <1-2.0; Cu, <1-119 and <1-1235; Fe, <0.5-35 and <0.5-1260; Mn, <0.5-364 and 3-420; Ni, <2 and <2; Pb, <1-2.5 and <1-10.5; S <10 and <10; and Zn, 1.3-253 and 1.0-1900. Levels of Cd, and Pb were below the max. permitted levels in Belgium drinking waters (10 µg Cd/l. and 50 µg Pb/l., respectively). MEG

14

Heavy metals in cane sugar products. II. [Lecture] Clarke, M. A.; Morris, N. M.; Tripp, V. W.; Carpenter, F. G.

Publications of Technical Papers and Proceedings of the Annual Meeting, Sugar Industry Technologists 33, 91-100 (1974) [15 ref. En] [S. Regional Res. Cent., USDA, New Orleans, Louisiana 70179, USA]

Using the same sugars and syrups as in previous work [see preceding abstr.], studies were made of Co, Ni, Cd and Zn contents, and revised results were obtained for Pb contents. A new AAS technique was developed for determining Pb and other metals of low volatility. Cd and Pb contents were well below any levels of concern to the industry or regulatory agencies. Results are presented in graphs and tables. Ranges of contents (ppm) in raw and refined sugar, respectively, were: Pb, 0.09-0.28, 0.006-0.03; Ni, 0.1-0.2, 0.05; Co, 0.02-0.06, <0.0008; Cd, <0.001-0.01, 0.0001-0.004; Zn, 0.005-0.9, <0.001-0.2. [See 8 3L217.] JA

15

[Cadmium contamination of foodstuffs.] Zur Kadmiumkontamination in Lebensmitteln.

Franzke, C.; Eckloff, B.

Zeitschrift für die Gesamte Hygiene und ihre Grenzgebiete 21 (10) 761-766 (1975) [46 ref. De, en, ru] [Humboldt-Univ., Bereich Lebensmittelchemie, Berlin (West)]

Cd contamination of foods is discussed on the basis of literature data, with reference to environmental sources of Cd contamination, migration of Cd from packaging materials, utensils etc., and the toxicity of Cd. IN

16

[Analysis of heavy metals in fruit juices.] Beitrag zur Analytik des Schwermetallgehaltes von Fruchtsäften.

Bielig, H. J.; Dreyer, H.; Treptow, H.

Flüssiges Obst 42 (9) 369-375 (1975) [10 ref. De, en, fr] [Inst. für Lebensmitteltech., Tech. Univ., Berlin (West)]

The following mean values (µg/kg) are tabulated for As, Pb and Cd contents, determined by AAS

using Perkin-Elmer equipment (number of samples in parentheses, metals in order stated above): apple juice, clear (16) 25.0, 40 and 7.7; apple juice, cloudy (10) 22.3, 38 and 8.2; apricot juice (1) 26, 36 and 10; pear juice (1) 32, 11 and 8; grapefruit juice (7) 24.3, 86 and 8.2; redcurrant juice (1) 20, 30 and 5; blackcurrant juice (21) 24.0, 46 and 8.1; cherry juice (20) 26.3, 36 and 8.1; orange juice (14) 30.6, 31 and 8.9; grape juice, red (18) 43.8, 101 and 9.2; grape juice, white (16) 41.4, 96 and 9.2; plum juice (1) 30, 15 and 9; blackcurrant mother-juice (1) 21, 28 and 9; cherry mother-juice (2) 30, 33 and 8; blackcurrant juice, 6-fold concentrate (1) 116, 220 and 80; and cherry juice, 6-fold concentrate (1) 146, 190 and 9.2. Hg contents of all unconcentrated juices tested above were $<5 \mu\text{g/kg}$; and for the 2 concentrates, they were 10 and 8, respectively. SKK

17

Determination of cadmium in fish tissue by flameless atomic absorption with a tantalum ribbon. Blood, E. R.; Grant, G. C.

Analytical Chemistry 47 (8) 1438-1441 (1975) [11 ref. En] [Dept. of Chem., Virginia Commonwealth Univ., Richmond, Virginia 23184, USA]

Samples of heart, skin, muscle, gut, gill, kidney, liver and bone tissue from bluegill (*Lepomis macrochirus*) exposed to water containing 3 ppm CdCl_2 for ≤ 2 wk were used in studies on detn. of Cd in fish by flameless AAS. Samples were analysed in an Instrumentation Laboratory model 153 atomic absorption spectrophotometer, using a model 335 flameless samples. Effects of background correction on Cd peak height were evaluated, and 2 wet digestion systems ($\text{HNO}_3/\text{H}_2\text{SO}_4$ or $\text{HNO}_3/\text{H}_2\text{O}_2$) were tested. Tables of results are given. Background correction reduced peak heights by $\leq 20\%$ indicating nonspecific absorption and/or light scattering during the analysis cycle. The $\text{HNO}_3/\text{H}_2\text{O}_2$ digestion method gave significantly lower % recovery (mean 84.8%) than the $\text{HNO}_3/\text{H}_2\text{SO}_4/\text{HClO}_4$ method (mean 96.2%). Sensitivity of the method (2×10^{-12} g) was concluded to be adequate for detn. of Cd in fish tissues. GL

18

[Determination of cadmium in fish from the Carinthian lakes.] Über die Bestimmung von Kadmium in Fischen aus Kärntner Seen. Weiser, M.; Lottermoser, A.; Weingarten, H.; Krocza, W. E.

Wiener Tierärztliche Monatsschrift 62 (6/8) 214-217 (1975) [10 ref. De, en] [Inst. für Med. Chemie, Tierärztliche Hochschule, Vienna, Austria]

95 specimens of fish from 9 Carinthian lakes representing 13 spp. (including pike, perch, roach, tench, barbel, bream, trout, white bream and carp) were examined. Approx. 10-g samples of fillet flesh were homogenized, freeze-dried, wet-ashed and analysed for Cd by atomic absorption flame

spectrophotometry. Mean values with SD ($\mu\text{g/kg}$) ranged for the 9 lakes from 32.0 ± 11.5 (6 specimens) for Turrach lake to 51.0 ± 16.5 (9 specimens) for Ossiacher lake. The overall mean was $39 \mu\text{g/kg}$ with a range of 0-87 $\mu\text{g/kg}$. No correlation was found between length (age) of fish of any one sp. and Cd concn. With 10 of the 13 spp, frequency distribution of Cd content was skew, most values lying below the $39 \mu\text{g/kg}$ mean. Differences between the lakes are discussed from the viewpoints of character and possible contamination. SKK

19

Metabolism and toxicity of cadmium, mercury and lead in animals; a review. [Review]

Neathery, M. W.; Miller, W. J.

Journal of Dairy Science 58 (12) 1767-1781 (1975) [112 ref. En] [Dep. of Anim. & Dairy Sci., Univ. of Georgia, Athens, Georgia 30602, USA]

Toxicity, absorption, blood transport, tissue distribution and metabolism of Cd, Hg and Pb in animals are reviewed in detail. Cd and Hg tend to accumulate in the kidneys and liver, while most Pb is retained in the skeleton. Relatively little of absorbed Cd and inorganic Hg in animals is secreted into milk or deposited in muscle. However, methyl mercury tends to be deposited in muscle and absorbed Pb is secreted into milk under certain conditions. MC

20

[Lead and cadmium contents of wines, musts and grapes in the vicinity of a source of contamination.]

Blei- und Cadmiumgehalte von Wein, Weinmost und Weintrauben aus der Umgebung einer Immissionsquelle. Mack, D.

Deutsche Lebensmittel-Rundschau 71 (12) 431-432 (1975) [9 ref. De, en, fr] [Chem. Landesuntersuchungsanstalt, Stuttgart, Federal Republic of Germany]

The author's rapid flameless AAS method [see FSTA (1975) 7 8H1169] was used in studies on the Pb and Cd contents of grapes and wines from the vicinity of a factory producing Pb- and Cd-containing pigments. Wine samples produced in 1969-1974 were studied; a table of results is given. Pb concn. ≤ 0.64 ppm and Cd concn. ≤ 0.041 ppm (both values considerably above normal levels) were recorded. Grapes were collected in 1973 and 1974 at various distances (200 m-15 km) from the factory; Pb and Cd concn. were determined in the resulting meshes. A table of results is given. Pb and Cd concn. decreased with increasing distance from the factory. Cd concn. in meshes made from grapes grown near the factory had very high Cd concn. (≤ 0.36 ppm); Pb concn. were generally within normal limits. Washing the grapes with HCl markedly reduced the Pb concn., but had little effect on the Cd concn. It is concluded that the Pb contamination is mainly on the surface of the grapes, but that Cd contamination is within the grape tissues. AJDW

21

[Studies of black tea. I. Contents of mercury, lead and cadmium in tea leaves and tea infusions.] Untersuchungen über schwarzen Tee. I. Gehalt an Quecksilber, Blei und Cadmium in Teeblättern und Teeaufgüssen.

Feldheim, W.; Stelte, W.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 159 (5) 293-296 (1975) [5 ref. De, en] [Inst. für Ernährungswissenschaft I, Justus Liebig-Universität, Giessen, Federal Republic of Germany]

In a survey of the content of toxic trace elements in 25 teas from different countries, Pb concn. was found to range up to 3.08 ppm, Cd up to 0.012 ppm, and Hg up to 3.0 ppm in air-dried tea leaves. The concn. in tea infusions was much lower: Pb up to 0.007 ppm and Cd below the level of detection [Hg content not determined]. AS

22

An appraisal of toxic metal residue in the soils of a disused sewage farm. II. Lead, cadmium and arsenic, with notes on chromium.

Pike, E. R.; Graham, L. C.; Fogden, M. W.

Journal of the Association of Public Analysts 13 (2) 48-63 (1975) [22 ref. En] [County Analyst's Dep., Fillingate, Wanlip, Leicester, UK]

Figures are given for the uptake by lettuce, radish, cabbage, cauliflower, carrot, tomato, beans, sprouts, potatoes and savoy o Pb, As, Cd and Cr derived from soils of a disused sewage farm. No definite evidence was found to show that abnormal amounts of these toxic metals were taken up by vegetables grown on such soils (concn. in soil (ppm) Pb 127-982, Cr 80-1160, Cd 2.8-18.0, As 8-36). Metal concn. in vegetables were normal, and in no instance was a statutory or recommended limit exceeded. [See FSTA (1975) 7 8J1217 for part I.] JRR

23

[Toxic heavy metals in cereals.] Toxische Schwermetalle in Getreide.

Ocker, H. D.; Hack, A. G.

Getreide, Mehl und Brot 29 (12) 305-308 (1975) [5 ref. De] [Bundesforschungsanstalt für Getreideverarbeitung, Detmold, Federal Republic of Germany]

Upper limits for the content of toxic metals in cereals and cereal products in the Federal Republic of Germany have been set for the present at (mg/kg): Hg 0.03, Pb 0.5, Cd 0.1, As 1.0. A survey was made of the Hg, Pb and Cd contents of wheat grown in the Federal Republic of Germany and Argentina, of maize grown in the Federal Republic, and of rice grown in many countries. Results are tabulated. In most cases the contents of the 3 metals were below the recommended upper limits. JVR

24

[Determination of lead, cadmium, copper and zinc in plant and animal material by atomic absorption spectrometry (flame and graphite-tube procedures) by the Schöniger method.] Bestimmung von Blei, Cadmium, Kupfer und Zink in pflanzlichem und tierischem Material mit Hilfe der Atomabsorption in der Flamme und im Graphitrohr durch Aufschluss des Materials nach dem Schöniger-Verfahren. [Lecture]

Vondenhoff, T.

Mitteilungsblatt der GDCh-Fachgruppe Lebensmittelchemie und Gerichtliche Chemie 29 (12) 341-345 (1975) [7 ref. De] [Lehrstuhl für Lebensmittelwissenschaft, Univ., Bonn, Federal Republic of Germany]

Detailed instructions (sample preparation, ashing, AAS conditions) are given for detn. of Cu and Zn by flame AAS, and for detn. of Pb and Cd by AAS using a graphite tube cuvette. At high concn., Cd may alternatively be determined by flame AAS; this technique is, however, unsuitable for Pb. Reference curves for Cd and Pb are non-linear; methods for overcoming this problem are briefly described. [See FSTA (1976) 8 6A294.] AJDW

25

[Effects of Mn^{2+} and Mg^{2+} on growth inhibition of lactic acid bacteria caused by Cd^{2+} .]

Savel, J.; Prokopova, M.

Kvasny Prumysl 21 (4) 79-80 (1975) [4 ref. Cs, ru, en, de] [Jihoceske Pivovary, n.p., Ceske Budejovice, Czechoslovakia]

The toxic effects of $CdCl_2$ on lactic acid bacteria were studied as affected by Mn and Mg salts. The results showed that the toxic effects of Cd^{2+} on their growth increased with reducing concn. of Mn^{2+} in the medium. Following addition of $MnSO_4$, the toxicity of Cd^{2+} was significantly higher for pediococci than for lactic acid bacteria, and increased considerably with decreasing concn. of Mn^{2+} . It was concluded that the toxic effects of Cd^{2+} on lactic acid bacteria are probably related to their need for Mn^{2+} for growth. STI

26

Accumulation of toxic heavy metals by plants in Missouri's lead belt. In "Trace element metabolism in animals - 2". [See FSTA (1976) 8 2A299.] [Lecture]

Hemphill, D. D.

pp. 458-460 (1974) [En] [Environmental Trace Substances Cent., Univ. of Missouri, Columbia, Missouri, USA]

This paper includes data for Pb and Cd concn. in samples of lettuces, radishes and green beans grown in: (i) N. Missouri, in an area with no lead mining or smelting, and little industrial activity; (ii) the 'old lead belt' in which lead mining and smelting have

been conducted for many years; and (iii) in the 'new lead belt', where lead mining and smelting has started fairly recently. Mean values (with ranges in parentheses) for Pb concn. were (for lettuces, radishes and green beans respectively, $\mu\text{g/g}$ dry wt.): (i) 20.6 (6.9-33.9); 7.7 (range not given), and ≤ 5 (range not given); (ii) 83.8 (10.3-742.0) 33.4 (5.0-518), and 5.4 (5.0-10.1); and (iii) 114 (range not given), 22.3 (range not given) and 8.8 (range not given). Cd concn. in the vegetables were generally $\leq 2 \mu\text{g/g}$ dry wt.; however, in a small town with a smelter operating since the 1890's, Cd concn. were (mean values with ranges in parentheses, $\mu\text{g/g}$ dry wt.): lettuce 13.02 (3.3-34.5); radish 4.72 (1.18-13.7); and green beans 2.36 (0.5-8.5). AJDW

27

Heavy metal contamination of vegetables and soil in domestic gardens around a smelting complex. Beavington, F.

Environmental Pollution 9 (3) 211-217 (1975) [9 ref. En] [Univ. of Wollongong, NSW, Australia]

Leaf vegetables and soil from gardens in a zone of 0.5 km radius around the Cu smelter in Wollongong, Australia were analysed by AAS for levels of Cu, Zn, Pb, Cd, Ni and Fe. Vegetables samples were lettuce, cabbage, garlic leaf, mint and chillies. Results are tabulated. Lettuce samples contained the highest levels with 23.0 ppm Pb and 4.5 ppm Cd compared with 10.3 ppm Pb and 1.16 ppm Cd for other leaf vegetables. Correlation coeff. between levels of metals in the vegetables are also tabulated. Highly significant correlations were found between distance from the chimney and levels of easily extractable metals in the soil. CRI

28

Determination of lead and cadmium in milk with modern analytical methods.

Jonsson, H.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 160 (1) 1-10 (1976) [26 ref. En, de] [Swedish Dairies' Ass., Cent. Lab., Malmö, Sweden]

Methods tested were differential-pulse anodic-stripping voltammetry (DPASV) and flameless atomic-absorption spectrophotometry (FAAS). Under the circumstances in which these methods were used, the analytical procedure based on DPASV was the most sensitive, with an estimated detection limit of about $0.2 \mu\text{g/l}$. for Pb and Cd in liquid milk. The pretreatment of the milk samples before the DPASV-analysis included: freeze-drying, ashing in a muffle furnace at 550°C and finally dissolution of the ash in 0.1M HCl. Recoveries of known amounts of Pb and Cd added to milk were 95 and 59%, respectively. In 98 samples of Swedish market milk the mean ($\pm\text{SD}$) Pb content was $2.0 \pm 0.5 \mu\text{g/l}$; Cd was $<0.2 \mu\text{g/l}$. in all the samples. AS

29

Atomic absorption analysis of liver without ashing. Hinners, T. A.

Zeitschrift für Analytische Chemie 277 (5) 377-378 (1975) [2 ref. En] [US Environmental Protection Agency, Res. Triangle Park, North Carolina 27711, USA]

The detn. of metals in liver by AAS without ashing is described. National Bureau of Standards bovine liver was extracted with 1% HNO_3 at room temp. and extracts analysed by flame atomic absorption spectroscopy. 98-103% recoveries were obtained for Cd, Cu, Mg, Mn, Na, K and Zn, and extraction efficiencies were 97-100% for these metals and Ca, but only 40% extraction efficiency for Fe. RM

30

[Cadmium and the environment.]

Cabassi, E.; Soana, S.

Rivista di Zootecnia e Veterinaria No. 5, 389-398 (1975) [30 ref. It, en] [Istituto di Microbiol., Fac. di Med. Vet., Univ., Parma, Italy]

Aspects considered in this paper include: uses of Cd; its distribution in the environment; contamination of foods; distribution in the body; toxicity; clinical and pathological aspects; and elimination of Cd from the body. Data are given for the Cd concn. in beef liver and kidney, fresh fish, oysters, other molluscs, cows' milk, carrots, potatoes, tomatoes, pears, apples, rice, wheat flour and barley in various countries. AJDW

31

Collaborative study of effect of light on cadmium and lead leaching from ceramic glazes.

Krinitz, B.; Holak, W.

Journal of the Association of Official Analytical Chemists 59 (1) 158-161 (1976) [6 ref. En] [FDA, 850 Third Avenue, Brooklyn, New York 11232, USA]

A limited interlaboratory study was carried out to determine the effect of lighting conditions on the release of Cd from ceramic glazes by 4% acetic acid. Cd release increased with increased exposure to light. Further interlaboratory study on plates manufactured under controlled conditions showed that if temp., intensity of illumination, and time of exposure are specified, reproducible results for leaching of both Pb and Cd can be obtained. A modification of the official AOAC method 25.031-25.034, to increase sensitivity was collaboratively studied by 8 laboratories. Each received 6 solutions of Pb in 4% acetic acid (3 sets of blind duplicates at the 0.1, 0.5, and $0.8 \mu\text{g/ml}$ levels) plus a reagent blank. Average recoveries were 0.1006, 0.5056, and $0.8194 \mu\text{g/ml}$, respectively, with coeff. of variation of 11.4, 3.3, and 2.8%, respectively. The proposed modification is simple, rapid, and accurate. The modification has been adopted as official first action, and a parameter for exposure to light during extraction has been included in the method. AS

32

Human milk as a dietary source of cadmium and lead. (In "Trace substances in environmental health - VI" [see FSTA (1976) 8 7A337].) [Lecture] Pinkerton, C.; Hammer, D. I.; Bridbord, K.; Creason, J. P.; Kent, J. L.; Murthy, G. K. pp. 39-43 (1973) [15 ref. En] [Nat. Environmental Res. Cent., Environmental Protection Agency, Res. Triangle Park, North Carolina 27711, USA]

Cd and Pb levels in (i) 14 human and (ii) 33 cows' milk samples obtained from the same geographic area (Cincinnati, Ohio, USA), were determined by AAS. Average Cd and Pb concn. were respectively 0.011 and 0.0109 ppm in (i) and 0.027 and 0.42 ppm in (ii). It was calculated that under conditions of a cows' milk + high solids diet, a bottle-fed infant could take in approx. $30 \times$ the level of Pb and $15 \times$ the level of Cd taken in by an exclusively breast-fed infant. Other data show estimated Cd intake at various stages of adolescence, from cows' milk and from solid food estimated to contain 0.066 ppm Cd [see G. K. Murthy et al., Environmental Science and Technology (1971) No. 5, 434]. MC

33

[Seasonal variations in cadmium content of mutugoro (*Boleophthalmus pectinirostris*) muscle, canned mutugoro and bottom mud in Ariake Bay.] Yamazoe, Y.; Otubo, F.

Journal of the Japanese Society of Food and Nutrition [Eiyo to Shokuryo] 28 (6) 343-346 (1975) [32 ref. Ja, en] [Nagasaki Women's Junior Coll., Yayoi-machi, Nagasaki, Japan]

Cd content of mutugoro muscle ranged from 0.09 to 0.12 ppm in 1970 and from 0.02 to 0.07 ppm in 1974; Cd content of canned mutugoro ranged from 0.10 to 0.20 ppm in 1970 and from 0.03 to 0.08 ppm in 1974. [From En summ.] [See also FSTA (1972) 4 4R200 & (1973) 5 12R574.] JA

34

[Spectrophotometric study of cadmium content in fish muscle tissue.]

Golovin, A. N.; Kirichenko, S. G.; Demina, L. L. **Rybnoe Khozyaistvo** No. 8, 68-70 (1975) [1 ref. Ru] [VNIRO, USSR]

A detailed description (including procedures for homogenization and ashing of the sample) is given of a flame AAS method for detn. of Cd in fish. Cd concn. determined in various fish spp. ranged from 0.030 to 0.130 mg/kg fish meat. STI

35

Experimental studies on cadmium flux through marine biota. (In "Comparative studies of food and environmental contamination" [see FSTA (1975) 7 5C146].) [Lecture]

Fowler, S. W.; Benayoun, G. pp. 159-178 (1974) [33 ref. En] [International Lab. of Marine Radioactivity, Monaco]

The role of mussels (*Mytilus galloprovincialis*) and benthic shrimp (*Lysmata seticaudata*) in the cycling of Cd in the marine environment was examined. Results of ^{109}Cd uptake experiments indicated that steady state between water and organisms was not reached after 2 months; concn. factors were 130 and 600 in whole mussels and shrimp respectively. Concn. factors based on stable Cd concn. were severaö times higher indicating incomplete equilibration between ^{109}Cd and stable Cd in the organisms. Highest ^{109}Cd concn. were found in the viscera, with lesser amounts in muscle, mantle, gills and shell of mussel, and exoskeleton, muscle and eyes of shrimp. Increased Cd uptake at higher temp. was noted in shrimp only. Cd uptake was directly proportional to Cd content of seawater, but was unaffected by varying Zn concn. Shrimp tended to lose Cd faster at high temp. (not significant over 2 months). Shrimp maintained in a flowing seawater system retained an average of 55% of their original ^{109}Cd body burden after 8 months. Biological half-life, computed over 7 months, was 378 days. The relatively slow loss of ^{109}Cd from mussels was unaffected by Zn levels in tissues or surrounding seawater. Mussels maintained at a field station lost significantly less ^{109}Cd than those held in a laboratory flowing seawater system during the first 3 months, but later the former fluxed Cd 4 times faster. This Cd flux is a relatively slow process in mussels and shrimps. AS

36

Cadmium toxicity in adults and early larval stages of the mussel *Mytilus galloprovincialis* Lam. (In "Comparative studies of food and environmental contamination" [see FSTA (1975) 7 5C146].) [Lecture]

Pavicic, J.; Järvenpää, T. pp. 179-188 (1974) [23 ref. En] [Cent. for Marine Res., Rudjer Boskovic Inst., Rovinj, Yugoslavia]

The critical toxicity concn. of Cd, added as CdCl_2 to sea water (37-38% salinity, temp. $20 \pm 1^\circ\text{C}$), was found to be between 0.25 and 1 ppm Cd^{2+} for adult mussels, with a 30-day median tolerance limit at 0.36 ppm Cd^{2+} . Tolerance to Cd did not increase significantly with age except for the heaviest mussels (10 g). Bioaccumulation of Cd^{2+} by adult mussels was estimated in experiments where $^{115\text{m}}\text{Cd}$ radiotracer was added into a series of basins with Cd^{2+} concn. of 0.25, 0.5, 0.8, 1.6 and 3.4 ppm. After 7 days, Cd^{2+} concn. in mussels was 23-50 times higher than in the basins

containing 1.6-0.25 ppm Cd^{2+} , and continued to increase throughout the experimental period of up to 33 days; animals only survived until accumulated Cd^{2+} concn. reached 20-60 ppm of the whole animal or 80-240 ppm in soft tissues. AL

37

Effects of dietary cadmium on growth and tissue levels in sheep. (In "Trace substances in environmental health - VI" [see FSTA (1976) 8 7A337]. [Lecture]

Doyle, J. J.; Pfander, W. H.; Grebing, S. E.; Pierce, J. O., II

pp. 181-186 (1973) [20 ref. En] [Dep. of Anim. Husbandry, Univ. of Missouri, Columbia, Missouri 65201, USA]

30 male lambs (approx. 4 months of age at the start of the experiment) were used in a 191-day feeding trial conducted to evaluate effects of diets containing 0, 5, 15, 30 or 60 ppm Cd (as CdCl_2) on growth, Cd concn. in the liver, kidney, fat and muscle tissue, and the wt. of various internal organs. Tables of results are given. Considerable accumulation of Cd was observed in liver and kidney (275.94 ppm and 768.84 ppm respectively for animals receiving the 60 ppm Cd diet, vs. 1.69 and 4.42 ppm respectively in animals receiving the control diet). Little accumulation of Cd was observed in muscle or fat. Diets containing 30 or 60 ppm Cd significantly increased liver wt.; dietary Cd had no significant effect on the wt. of other internal organs. AJDW

38

On the interaction of melanoidin with metallic ions. Gomyo, T.; Horikoshi, M.

Agricultural and Biological Chemistry 40 (1) 33-40 (1976) [7 ref. En] [Lab. of Nutr. Sci. of Food, Kagawa Nutr. Coll., Toshima-ku, Tokyo, Japan]

Melanoidin, obtained from a browning solution prepared from a glycine/D-glucose system by acid precipitation, displays a noticeable character attributable to an amphoteric polyvalent electrolyte with the isoelectric point at pH 2.5. The number of protons released during titration from the isoelectric point to pH 11.0 is approx. 500/molecule of melanoidin. Thus, melanoidin shows a remarkable coagulation in the presence of various metallic ions though affected by metal concn., pH and the presence of other chelating agents such as EDTA. The behaviour of melanoidin towards metallic ions is in common with anionic hydrophilic colloids. The metal binding ability of melanoidin was confirmed on the basis of difference spectra, titration curves and dialysis equilibria. The stability constants and the number of binding sites were approx. calculated from the results of dialysis equilibria in respect to Fe^{3+} and Cu^{2+} . Melanoidin was evaluated as a powerful metal scavenger in an attempt to elucidate its antioxidative effect. AS

39

[Metal poisoning by items of utility.] [Lecture] Nuijt, M. F.

Voeding 37 (3) 110-116 (1976) [4 ref. Nl, en] [Keuringsdienst van Waren, Haarlem, Netherlands]

Release of Pb and Cd from glazed ceramics and enamelled utensils is discussed, with reference to Dutch and foreign test methods and tolerances. The effect of light on Cd release is briefly considered. A brief account is given of studies on uptake of Pb from a fondue dish by 3% acetic acid model solution and various liquid and solid foods; liquids were tested with 3 successive contact periods of 2 h (using a fresh food sample each time); solid foods were tested with 2 successive 2 h periods. Histograms of results are given. Solids took up less Pb than liquids; Pb uptake increased with decreasing food pH. Coca-cola and other soft drinks had higher Pb uptakes than the 3% acetic acid solution. Effects of contact time on Pb uptake are discussed. AJDW

40

[Factors influencing the toxicity of heavy metals in food.] [Lecture]

Huisingh, D.; Huisingh, J.

Tecnologia de Alimentos 10 (4) 145-151, 153-156, 158, 188 (1975) [59 ref. Es, en] [N. Carolina State Univ., Raleigh, N. Carolina 27607, USA]
See FSTA (1975) 7 3C78.

41

Determination of lead, cadmium, and zinc in sugar.

Morris, N. M.; Clarke, M. A.; Tripp, V. W.; Carpenter, F. G.

Journal of Agricultural and Food Chemistry 24 (1) 45-47 (1976) [10 ref. En] [S. Regional Res. Cent., USDA, New Orleans, Louisiana 70179, USA]

A new technique for eliminating matrix interference in the detn. of Pb, Cd and Zn in sugars by flameless atomic absorption is described. Yeast fermentation converts the sucrose to ethanol and CO_2 , both of which are easily volatilized. Reproducible results for these elements are obtained with this technique. Relative SD for Pb and Cd was <10%, and for Zn <17%. Using this yeast fermentation technique, it was found that all 3 elements were present in raw and refined sugars at levels well below limits recommended by regulatory agencies. AS

42

[Toxic heavy metals - analysis and importance for the starch industry.] Toxische Schwermetalle - Analytik und Bedeutung für die Stärkeindustrie. [Lecture]

Ocker, H. D.

Stärke 27 (10) 338-343 (1975) [6 ref. De, en, fr] [Bundesforschungsanstalt für Getreideverarbeitung, D-4930 Detmold, 1, Am Schützenberg 12, Federal Republic of Germany]

Present Federal German legislation on max. permissible levels of toxic heavy metals in foods is discussed. The following tolerances are proposed for cereals and cereal products (mg/kg): Hg 0.03, Pb 0.5, Cd 0.1, As 1.0. Methods of analysis are discussed with reference to problems of interfering substances ('matrix effect'). A survey of contamination of grain in the Federal Republic, on the basis of published data, showed that domestic bread wheat contained <0.01 ppm Hg, 0.05-0.45 ppm Pb and generally about 0.05 ppm Cd (no figure given for As). A few samples of imported rice contained >20 parts/billion (ppb) Hg. Imported maize for starch production contained 0.0012-0.0024 ppm Hg, 0.002-0.008 ppm Cd and 0.02-0.25 ppm Pb; corresponding levels in domestic maize were, respectively (mean values in ppb for 7 var.): 1.8-6.2, 7-41 and 39-42. Most heavy metal contamination is removed during processing of cereals, e.g. dry dehulling. RM

43

Distribution and removal of cadmium from milk. Roh, J. K.; Bradley, R. L., Jr.; Richardson, T.; Weckel, K. G.

Journal of Dairy Science 59 (3) 376-381 (1976) [17 ref. En] [Dep. of Food Sci., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

Distribution of added Cd in milk systems and the feasibility of removing Cd were investigated. In milk containing 1 ppm Cd, 96% of the added CdCl₂ was dispersed in the skim-milk fraction, and 3% was associated with the cream fraction. Cd was not bound strongly to any protein fraction. The association of Cd with acid casein, whey proteins and the fat globule membrane was 18, 6, and 0.5% of total added Cd. With a 5-min exposure thiosuccinylated aminoethyl cellulose and thionitrocarboxyphenylated aminoethyl cellulose resins and reduced human hair removed 72, 70 and 30%, respectively, of added Cd in skim-milk previously equilibrated for 2 h at 37°C. Increasing equilibration time beyond 24 h had no effect on removal efficiency whereas increasing pH decreased Cd removal markedly. AS

44

National Marine Fisheries Service preliminary survey of selected seafoods for mercury, lead, cadmium, chromium, and arsenic content.

Zook, E. G.; Powell, J. J.; Hackley, B. M.; Emerson, J. A.; Brooker, J. R.; Knobl, G. M., Jr. *Journal of Agricultural and Food Chemistry* 24 (1) 47-53 (1976) [14 ref. En] [Southeast Util. Res. Cent., Nat. Marine Fisheries Service, Nat. Oceanic & Atmospheric Administration, US Dep. of Commerce, College Park, Maryland 20740, USA]

A preliminary screening study was conducted on Hg, Pb, Cd, Cr and As contents of 34 commonly consumed seafoods. 334 samples were analysed and, in general, 10 samples/species were obtained from a location. >96% of the samples fell below the FDA guideline of 0.5 ppm for Hg, with a mean level of 0.13 ppm. Mean Pb values among species

tended to be rather uniform and only a few species averaged >0.6 ppm. No species mean exceeded 1 ppm. Cd content of most seafoods averaged <0.2 ppm. Cr was present at <0.4 ppm in all species. Arsenic levels showed the widest variation and were higher for some species than the other elements tested. Some possible relationships between elements within each species were encountered, but the data were too limited to draw firm conclusions. AS

45

Content of copper, zinc, lead, cadmium and mercury in muscle, liver and kidney of Finnish cattle.

Stabel-Taucher, R.; Nurmi, E.; Karppanen, E. *Journal of the Scientific Agricultural Society of Finland* 47 (6) 469-479 (1975) [24 ref. En, fi] [State Vet. Med. Inst., Helsinki, Finland]

Cu, Zn, Pb, Cd and Hg were determined by AAS in samples of muscle, liver and kidney tissue from a total of 120 cattle from 6 regions of Finland. Imported liver samples (10 from Australia, 10 from Poland and 15 from Ireland) were also studied. Tables of results are given. Mean values and ranges for Finnish samples (for muscle, liver and kidney respectively) were (mg/kg wet wt.): Cu 0.88 and 0.35-1.98, 59.7 and 3.5-199.0, and 4.11 and 2.2-6.0; Zn 50.4 and 14.7-95.3, 38.9 and 14.5-80.0, and 18.1 and 12.5-27.0; Pb 0.10 and 0.032-0.50, 0.27 and 0.06-0.75, and 0.28 and 0.05-0.85; Cd 0.02 and 0.001-0.95, 0.14 and 0.018-0.54, and 1.02 and 0.05-3.98; and Hg not detectable 0.03, not detectable 0.05, and not determined. Finnish liver samples had higher Cu concn. than the imported samples; concn. of Zn, Pb, Cd and Hg in Finnish and imported samples were similar. Correlations between Zn, Pb and Cd concn. in muscle, liver and kidney tissue from Finnish cattle are also given. AJDW

46

Automated wet ashing and multi-metal determination in biological materials by atomic-absorption spectrometry.

Frank, A.

Zeitschrift für Analytische Chemie 279 (2) 101-102 (1976) [1 ref. En] [Nat. Vet. Inst., Stockholm, Sweden]

A commercially available wet ashing apparatus (Tecator AB, Helsingborg, Sweden) was modified by mounting a synchronous timing motor with a suitable gearbox on the front panel of the thermostat unit; this modification allows adjustment of the heating profile to suit different oxidizing mixtures and types of biological material. The material to be analysed is ashed with acidic oxidizing mixtures and the digested acidic solution obtained is subjected to AAS for detn. of various metals, e.g. Cd, Cu, Fe, Mn, Zn, Pb. The method is suited to wide metal concn.; examples of its use include diagnosis of heavy metal poisoning in animals and study of environmental pollution by heavy metals. JA

47

Environmental quality and safety. Supplement Vol. I. Heavy metal toxicity, safety and hormology. [Book]

Luckey, T. D.; Venugopal, B.; Hutcheson, D. P. 120pp. ISBN 3-13-516301-6 (Georg Thieme); ISBN 0-12-227061 (Academic Press) (1975) [many ref. En] Stuttgart, Federal Republic of Germany; Georg Thieme Publishers & New York, USA; Academic Press. Price DM35 [Univ. of Missouri, Columbia, Missouri 65201, USA]

Chapters in this book are: Introduction, by T. D. Luckey (pp. 1-3); Toxicology of non-radioactive heavy metals and their salts, by B. Venugopal & T. D. Luckey (pp. 4-73); Safety of heavy metals as nutritional markers, by D. P. Hutcheson, D. H. Gray, B. Venugopal & T. D. Luckey (pp. 74-80); Hormology with inorganic compounds, by T. D. Luckey (pp. 81-103); and References (pp. 104-118). [See FSTA (1974) 6 11A499 & 11A500 for Vol. II.] AL

48

[The food chain and bioaccumulation.] [Review] Yoshida, T.

Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 16 (6) 345-351 (1975) [56 ref. Ja] [Tokyo Univ. of Fisheries, Konan 4-5-7, Minato-ku, Tokyo, Japan]

General features of bioaccumulation of chemical substances in the food chain are reviewed, emphasis being placed on marine life, the mechanisms of bioaccumulation, and newly developed methods for detecting chlorinated hydrocarbons and heavy metals. TM

49

[An attempt to estimate the total daily intake of pesticide and polychlorinated biphenyl (PCB) residues and trace heavy metals.]

Ushio, F.; Fukano, S.; Nishida, K.; Kani, T.; Doguchi, M.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 25, 307-312 (1974, publ. 1975) [15 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo 160, Japan]

An estimation was made of the dietary intake of pesticide and PCB residues and of Hg, Cd and Pb by 20-29 yr-old males. Foods representing a 4-day diet were collected from stores in Tokyo. Uncooked foods were divided into 4 food groups (cereals; fish and shellfish; meat and dairy products; vegetables and seasonings) and subjected to analysis. The average daily intake of the substances was calculated as: PCB 8 µg, total BHC 3.5 µg, total DDT 4.7 µg, dieldrin 1.7 µg, Hg 35 µg, Cd 38 µg, and Pb 205 µg. AS

50

[DDTC-MIBK (diethyl-dithiocarbamate (sodium (sodium salt)/methyl isobutyl ketone) extraction system for simultaneous determination of heavy metals in foods by atomic absorption spectrophotometry. I. Determination of chromium in foods containing a large amount of calcium and phosphate.]

Nishigaki, S.; Tamura, Y.; Maki, T.; Yamada, H.; Toba, K.; Shimamura, Y.; Kimura, Y.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 24, 231-237 (1972, publ. 1973) [27 ref. Ja, en] [Div. of Food Hygiene, Dep. of Food Hygiene & Nutr., Tokyo Metropolitan Res. Lab. of Public Health, Tokyo, Japan]

In foods containing large amounts of Ca and phosphate, the DDTC-MIBK extraction method can be employed prior to Cr detn. by AAS provided ammonium persulphate is employed for oxidation of Cr. The pH of the Cr-DDTC complex should be adjusted with a buffer solution for extraction with MIBK. The limit of detection of the method is 0.01 ppm. Tabulated data [in English] show the levels of Cr, Cd, Pb, Cu, Zn and Co found in various types of fish and shellfish, milk and milk powder, bacon and vegetable protein. [From En summ.] JA

51

[Hygienic chemical studies on harmful elements. V. Contents of heavy metals in vegetables and fruits.]

Amemiya, T.; Ito, K.; Yamazoe, R.; Harada, H.; Totani, T.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 25, 127-132 (1974, publ. 1975) [18 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo 160, Japan]

A survey was made in 1971-1973 of the contents of Cd, Pb, As, Cu, Zn and Mn in tomato, cucumber, spinach, potato, tea, apple, strawberry and summer orange collected from retail outlets. The samples were digested with sulphuric and nitric acids. The elements were then determined in the digested solution by spectrophotometry, using silver diethyldithiocarbamate and AAS. Ranges and mean values for the 3 yr are tabulated [in English]. [From En summ.] [See FSTA (1973) 5 3C76 for part II.] JA

52

The substoichiometric extraction system MIBK/APDC and its application to the direct determination of Pb and Cd in wine.

Anders, U.; Hailer, G.

Zeitschrift für Analytische Chemie 278 (3) 203-206 (1976) [32 ref. En, de] [Chem. Landesuntersuchungsanstalt, Hedingerstrasse 2a, Sigmaringen, Federal Republic of Germany]

The insolubility of sugars and fruit acids in methyl isobutyl ketone (MIBK) allows direct

extraction of heavy metals by ammonium pyrrolidine dithiocarbamate (APDC) from wine and similar products. A method is described allowing detn. of 0.1-1 ppm Pb and 1-10 parts/billion Cd with $\pm 5\%$ accuracy. Ethanol concn. of 4-20% or use of a buffer had no effect on accuracy, inside the 5% margin of error. Reduction of the extraction time (25 min agitation and 15-20 min centrifugation at 5000 rev/min) increased the average error to -5 to -20%. A literature survey is included. RM

53

[Sake purification.]

Matsui, T.

Japanese Patent 5 105 077 (1976) [Ja]

Sake which has been brewed from Cd contaminated rice is purified by passage through a strongly acidic ion-exchange resin. IFT

54

Physical-chemical characteristics and heavy metal content of corn grown on sludge-treated strip-mine soil.

Garcia, W. J.; Blessin, C. W.; Inglett, G. E.; Carlson, R. O.

Journal of Agricultural and Food Chemistry 22 (5) 810-815 (1974) [6 ref. En] [N. Regional Res. Lab., USDA, Peoria, Illinois 61604, USA]

Corn was grown on strip-mine soil where anaerobically digested liquid sludge had been applied at a rate of 25 tons of sludge solids/acre. An adjacent plot of soil received no sludge. Corn grain grown on untreated strip-mine soil was characterized as immature and kernel size varied from small to intermediate, with about 20% of the kernels being diseased. In contrast, sludge-grown corn was well developed and corn yield increased fourfold over the untreated corn. Furthermore, a significant protein enhancement of 2.5% points was also realized. Concn. of 7 heavy metals (Zn, Mn, Cu, Pb, Cr, Cd, Hg) increased in grain, cobs, and husks in that order. For corn grain grown on untreated and sludge-treated soils, essentially no significant differences were found in heavy metal content when compared to 11 other corn var. grown normally. Heavy metal contents of both soil and sludge samples were also determined. AS

55

[Basic problems in achieving healthy nutrition. II. Effect of exhaust gases on lead and cadmium contents of green feeds, milk and excreta.]

Grundsatzfragen zur Erzeugung einer gesunden Ernährung. II. Einfluss von Kraftfahrzeugabgasen auf den Blei- und Cadmiumgehalt von Grünfütter, Milch und Exkrementen. [Lecture]

Schmid, G.; Rosopulo, A.; Weigelt, H.

Landwirtschaftliche Forschung Sonderheft 31/II, 150-159 (1975) [4 ref. De, en, fr] [Bayerische Landesanstalt für Bodenkultur & Pflanzenbau, München-Freising, Federal Republic of Germany]

During May-Oct. 1973, 30 cows were on (i) a high mountain pasture (altitude, 1200 m) not

exposed to motor traffic, while 30 other cows were on (ii) a pasture adjacent to a busy lntal motorway. Pb content of (i) pasture ranged from 5.3 to 7.3 ppm in DM, while that of (ii) increased from 3.5 ppm in DM initially to 13.6 ppm. Cd contents of (i) and (ii) showed similar ranges (0.09-0.17 and 0.08-0.15 ppm in DM respectively). There was no differences in Pb contents of (i) and (ii) milks (means and ranges 30 and 20-40 $\mu\text{g/l}$. in both) or in Cd contents (means 1.2 $\mu\text{g/l}$.; ranges 1.0-1.5 and 1.0-1.4 $\mu\text{g/l}$. respectively). SKK

56

[Studies on the accumulation of trace elements in fish. II. Relationship between body weight and concentrations of copper and zinc in muscle of sea fish.]

Nishigaki, S.; Tamura, Y.; Maki, T.; Yamada, H.; Shimamura, Y.; Kimura, Y.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 25, 241-244 (1974, publ. 1975) [13 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo 160, Japan]

The concn. of Cu and Zn in muscle tissue generally remained constant or decreased with increased body weight of tuna and swordfish. The contents of Cr, Cd, Pb, Cu, Zn and As in various species of sea fish are tabulated [in English]. [From En summ.] JA

57

[Study of trace elements in marine fish. I.

Distribution of heavy metals in bonito tissue.]

Katsuki, Y.; Yasuda, K.; Ueda, K.; Kimura, Y.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 25, 257-263 (1974, publ. 1975) [27 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo 160, Japan]

5 freshly caught bonitos, 52-55 cm long, which had been caught in Japanese coastal waters were studied for the distribution of heavy metals in their organs and muscles. Mn, Pb, Co, Cd, Cu, Cr, Zn and total and methyl mercury were detected and determined by AAS and GLC. Results are tabulated [in English]. Hg tended to accumulate in muscle rather than in internal organs and averaged 0.29 ppm in muscle; about 90% was present as methyl mercury. Heavy metals other than Hg tended to accumulate in the internal organs rather than in muscle. [From En summ.] JA

58

[Cadmium in the flesh and organs of slaughter cattle.] Cadmium in Fleisch und Organen von Schlachtrindern. [Lecture]

Kreuzer, W.; Sansoni, B.; Kracke, W.; Wissmath, P. *Proceedings of the European Meeting of Meat Research Workers* 19 (Part II) 947-968 (1973) [21 ref. De, en, fr] [Bereich für Hygiene & Tech. der Lebensmittel Tierischen Ursprungs, Univ., Munich, Federal Republic of Germany]

Effects of breed, sex, age and area of Germany

(Bavaria/Swabia, or the Weser marsh area) on the Cd concn. of bovine muscle, kidney, liver and spleen tissue were studied. Tables and histograms of results are given. Muscle had very low Cd concn. (≤ 5 parts/billion). The other tissues studied had considerably higher Cd concn. (≤ 1.660 ppm in kidney, ≤ 0.300 ppm in liver, and ≤ 0.210 ppm in spleen). Cd concn. in kidney and liver tissue tended to increase with age of the animal. Effects of the other factors studied were small. [See FSTA (1976) 8 9S1589.] AJDW

59

Metal contaminants in various food colours.

Khanna, S. K.; Singh, G. B.; Hasan, M. Z.
Journal of the Science of Food and Agriculture 27 (2) 170-174 (1976) [26 ref. En] [Ind. Toxicology Res. Cent., Mahatma Gandhi Marg, Post Box No. 80, Lucknow, Uttar Pradesh, India]

As, Cd, Cr, Co, Cu, Pb, Mn, Ni and Zn were estimated in 18 permitted and 18 non-permitted food colours. As, Cr, Cu and Pb were found to be within the max. allowable international limits in all the permitted colours, but they were in excess in a number of non-permitted colours. There is a case for establishing the max. allowable concn. (MAC) of Cd, Co, Mn, Ni and Zn in food colours. AS

60

[Detection of extractable heavy metals in glazed pottery, porcelain and enamel ware.]

Fujii, T.; Sato, K.; Shiba, H.; Nakajima, S.; Yamato, O.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 23, 253-259 (1971, publ. 1972) [3 ref. Ja, en] [Dep. of Food Hygiene and Nutr., Tokyo Metropolitan Res. Lab. of Public Health, Tokyo, Japan]

During the period April 1971-March 1972, 119 samples of glazed pottery and porcelain, and 48 samples of enamel ware were examined for extractable heavy metals. 3 glazed pottery samples and 1 enamel ware sample were found, on the basis of their extractable heavy metal content, to be unsuitable for use as table-ware, according to limits stipulated by the Japanese Food Sanitation Law. In the USA, regulations require that table-ware should not release >7 ppm Pb and >0.5 ppm Cd when extracted with 4% acetic acid for 24 h at room temp. If this regulation were applied to the results of this study, 55 of the 119 glazed pottery and porcelain samples and 14 of the 48 enamel ware samples would be rejected. It is therefore recommended that the limit for extractable heavy metals, as stipulated in the Japanese Food Sanitation Law, be revised. AS

61

[Cadmium and lead in brewed coffee.]

Stenström, T.; Vahter, M.

Vår Föda 27 (3) 150-156 (1975) [6 ref. Sv, en] [Omgivningshygieniska Avdelning, Naturvårdsverk, S-104 01 Stockholm, Sweden]

Uptake of Cd and Pb by water during boiling was studied with 20 types of domestic coffee-

making machine on sale in Sweden. The water used was of pH 8.3, and had initial Pb and Cd concn. of 0.6-0.8 $\mu\text{g/l.}$ and 0.06 $\mu\text{g/l.}$ respectively. Samples of one machine gave very high Cd concn. (≤ 99 $\mu\text{g/l.}$) in the boiled water; after daily use for 4 wk, it still gave a Cd concn. of approx. 40 $\mu\text{g/l.}$ Another type gave very high Pb concn. (≤ 260 $\mu\text{g/l.}$). Sources of heavy metal contamination are discussed, with special reference to solder and Pb-containing brass. The potential health hazard from water containing Pb and Cd concn. of this order of magnitude is discussed. Losses of Cd from the water during infusion and filtration of tea and coffee were studied. 19-38% of the Cd in the water was present in the filtered coffee; 70-91% of the Cd in the water was present in the tea infusion. AJDW

62

[Oligoelements in domestic and foreign wines.]

Modi, G.; Guerrini, M.; Signorelli, L.

Bollettino dei Laboratori Chimici Provinciali 27 (1) 28-48 (1976) [40 ref. It, de, en, fr] [Lab. Chimico Provinciale di Firenze, Florence, Italy]

The results of quantitative analyses of Cd, Pb, Fe, Cu and Zn concn. in 220 domestic and foreign wines are presented in tables and include: Cd mean 0.007 ppm, max. 0.023 ppm, 47 samples >0.01 ppm; Pb mean 0.264 ppm, max. 1.09 ppm, 39 samples >0.3 ppm; Fe mean 8.46 ppm, max. 30.45 ppm; Cu mean 0.348 ppm, max. 2.653 ppm, 6 samples >1 mg/l.; Zn mean 2.082 mg/l., 1 sample >5 ppm (7.381 mg/l.). Causes of Cd and Pb contamination and methods of elimination of the residues are discussed. RM

63

Influence on the levels of heavy metals in soil and plant from sewage sludge used as fertilizer.

Andersson, A.; Nilsson, K. O.

Swedish Journal of Agricultural Research 6 (2) 151-159 (1976) [15 ref. En] [Dep. of Soil Sci., S-750 07 Uppsala 7, Sweden]

The effects of fertilization with sewage sludge on Mn, Zn, Cu, Ni, Co, Cr, Pb, Cd and Hg concn. in barley, oats and spring wheat were studied in pot and field trials. Tables of results are given. Application of sewage sludge increased concn. of Zn, Cu, Ni and Cd (but not the other heavy metals) in the grain. The suitability of sewage sludge for use as a fertilizer is discussed, with reference to the danger of uptake of significant concn. of heavy metals by food crops. AJDW

64

Accumulation of cadmium by the American oyster, *Crassostrea virginica*.

Zarogian, G. E.; Cheer, S.

Nature, UK 261 (5559) 408-410 (1976) [13 ref. En] [US Environmental Protection Agency, Environmental Res. Lab., Narragansett, Rhode Island 02882, USA]

Adult 3-yr-old oysters kept in following unfiltered seawater containing 0.005 ppm Cd accumulated ≤ 10.75 $\mu\text{g/g}$ wet wt. in 40 wk. This,

plus Cd naturally present (mean 2.72 ppm), brought Cd concn. in soft tissue to 13 ppm, which represents a potential health hazard if oysters constitute a major item of diet. Every 4 wk throughout the 40 wk trial 5 oysters from both experimental and control groups were analysed. Rate of accumulation in July and Aug. was more than double that in winter and spring. AL

65

[Short- and long-term studies on extraction of lead and cadmium from kitchenware.]

Beckmann, I.; Sark, M.

Var Föda 26 (9/10) 248-257 (1974) [10 ref. Sv, en] [Statens Livsmedelsverk, S-104 01 Stockholm, Sweden]

Release of Cd and Pb from glazed and enamelled kitchen utensils was studied; short-term tests were conducted by boiling 3 times with acetic acid (4 g/l.), and long-term tests were conducted by holding the vessel (filled with acetic acid solution) for 24 h at room temp. Studies were also conducted on extraction of Pb and Cd by citric acid solution or fruit juices. Tables of results are given. The boiling method tended to give higher values than the room temp. method. Citric acid and fruit juices gave similar results to acetic acid. During long-term storage trials, Cd and Pb concn. in the test solution increased continuously. It is suggested that food should not be stored in red, orange or yellow glazed or enamelled containers. AJDW

66

[Lead and cadmium contents of foods. I. Lead and cadmium contents of spices and table salt.] Blei und Cadmium-Gehalte von Lebensmitteln. I. Blei- und Cadmium-Gehalte von Gewürzen und Kochsalz.

Boppel, B.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 160 (3) 299-302 (1976) [7 ref. De, en] [Inst. für Strahlentech., Bundesforschungsanstalt für Ernährung, Engesserstrasse 20, D-7500 Karlsruhe 1, Federal Republic of Germany]

The Pb and Cd contents were determined in >50 commercially available spices and spice mixtures obtained from various manufacturers and in 14 samples of table salt. Ranges of Pb found (ppm) were: spices, 0.04-4.8; salt, 0.03-1.8; and of Cd (ppm): spices, below the detection level (0.004 ppm)-1.5; salt, below the detection level-0.01. About 75% of the spices contained <1 ppm Pb and about 60% <0.1 ppm Cd. Savory, ginger, dill and tarragon all contained >1 ppm Pb and >0.1 ppm Cd. JA

67

[Lead and cadmium contents of foods. II. Lead and cadmium contents of commercially prepared soups.]

Blei- und Cadmium-Gehalte von Lebensmitteln. II. Blei- und Cadmium-Gehalte von Fertigsuppen.

Boppel, B.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 161 (2) 111-113 (1976) [3 ref. De,

en] [Inst. für Strahlentech., Bundesforschungsanstalt für Ernährung, Engesserstrasse 20, D-7500 Karlsruhe 1, Federal Republic of Germany]

Pb and Cd contents were determined in 30 commercially prepared soup products (soup powders and cubes) from several manufacturers. The mean Pb content was 0.28 ppm. 29 samples contained between 0.095 ppm and 0.45 ppm, 1 sample contained 1.4 ppm. The mean Cd content in 21 products was 0.025 ppm (highest value 0.052 ppm). In the other samples Cd was not found (<0.004 ppm Cd). AS

68

[Cadmium in the environment and in foods.]

Mauro, A.

Industria Alimentari 15 (5) 86-89 (1976) [3 ref. It] [Lab. Chimico Provinciale IP, Catanzaro, Italy]

69

[Determination of traces of lead and cadmium in aperitifs by flameless AAS.]

Ooghe, W.; Kastelijn, H.

Annales des Falsifications et de l'Expertise

Chimique 69 (739) 351-367 (1976) [23 ref. Fr] [Lab. de Bromatologie, Inst. de Pharmacie, 135 De Pintelaan, B-9000 Ghent, Belgium]

The Pb content of 11 white and 17 red aperitifs, measured by flameless AAS after mixing 1 ml sample with 25 µl conc. HNO₃ and 100 µl 5% La solution (5.864 g La₂O₃ + 25 ml conc. HNO₃ in 100 ml), ranged from 40 to 261 µg/l. with a mean value of 127 µg/l. Cd, extracted from the samples with methylisobutylketone and 5% ammonium pyrrolidine dithiocarbamate, varied from 0.19 to 5.56 µg/l. with a mean value for the 28 samples of 1.42 µg/l. The levels of Pb and Cd found in the aperitifs were below the max. permitted levels for drinking water (300 µg Pb/l. and 10 µg Cd/l.). MEG

70

Trace metal levels in eels grown in power station cooling water.

Romeril, M. G.; Davis, M. H.

Aquaculture 8 (2) 139-149 (1976) [10 ref. En] [Marine Biol. Lab., Cent. Electricity Generating Board, Fawley, Southampton, UK]

Measurements were made of Cd, Cu, Fe, Ni and Zn concn. in the liver and muscle tissue of eels grown in (i) condenser discharge water (mean annual temp. 25°C), (ii) cooling-tower pond water (19°C), and a control group in (iii) Trent river water (15.5°C). Highest Zn and Ni levels were found in eels from (iii), Cd levels were highest in liver tissue from (iii) and lowest in muscle from (ii), lowest Cu levels were from (ii), and lowest Fe levels in liver from (iii) and muscle from (i). No abnormal accumulation of heavy metals was found in the fish kept at elevated temp. in power station cooling water, and the fastest growing eels, in (i), seemed to develop new tissue faster than they accumulated metals, thus reducing the specific

metal concn. Eels from 6 other locations were also analysed for comparative data; Cd in muscle samples did not constitute a health risk when consumed, but high levels in liver were associated with the polluted areas of the Bristol Channel. AL

71

[Cadmium and lead in the livers and kidneys of slaughter animals.]

Beckman, I.; Haeggglund, J.; Lundström, H.; Sark, M.; Slorach, S.

Var Föda 26 (4) 70-75 (1974) [13 ref. Sv, en] [Statens Livsmedelsverk, S-104 01, Stockholm, Sweden]

Pb and Cd concn. were determined in kidney and liver samples from (i) 9 calves, (ii) 28 adult cattle, (iii) 12 pigs, (iv) 16 sheep, (v) 1 foal and (vi) 13 adult horses. A table of results is given. Mean values for Pb concn. were, in kidney and liver respectively (mg/kg): (i) 0.32 and 0.33; (ii) 0.59 and 0.40; (iii) 0.26 and 0.26; (iv) 0.51 and 0.56; (v) 0.3 and 1.5; and (vi) 0.38 and 0.34. Corresponding values for Cd were (mg/kg): (i) 0.25 and 0.06; (ii) 0.62 and 0.11; (iii) 1.02 and 0.12; (iv) 0.43 and 0.34; (v) 0.04 and 0.04; and (vi) 31 and 2.6. The significance of these results is discussed, in relation to the suitability of these foods for human consumption. It is concluded that, with the exception of horse kidneys, all these foods are suitable for human consumption. AJDW

72

[The lead and cadmium content of meat and organ samples from slaughter animals.] Untersuchungen auf den Gehalt an Blei und Cadmium in Fleisch- und Organproben bei Schlachttieren.

Holm, J.

Fleischwirtschaft 56 (3) 413-416 (1976) [24 ref. De, en, fr] [Staatliches Veterinäruntersuchungsamt, Dresdenstrasse 6, 3300 Braunschweig, Federal Republic of Germany]

The lean meat, livers and kidneys of cows, bullocks, bulls, calves, pigs, sows (50 samples of each) and of 28 horses, and livers and kidneys of 50 hares were examined for Pb and Cd and results tabulated. Except for Cd in horse meat (0-1.503 ppm, mean 0.148), the concn. of both metals in meat was low and well below the max. tolerances. Appreciable numbers of animals had concn. > the suggested max. of 0.5 ppm in liver and/or kidneys. Individual animals had high Pb concn. in liver, and/or high Cd concn. in kidneys. Cd contamination was mainly observed in kidneys of cows, pigs, sows, hares and especially in horses (0.79-369.56 ppm, mean 52.49). Hare livers were heavily contaminated with Pb (0.92-3.82 ppm, mean 1.75). While correlation coeff. for the metal concn. in liver with concn. in meat or kidney were low, high correlations were observed between Pb concn. in beef liver and in muscle or kidneys in cases of Pb poisoning. Owing to the high Cd concn. observed, consumption of kidneys from cows, pigs, sows and horses and hare livers is discouraged. RM

73

Bioenergetics: a procedure for detecting food contamination.

Squibb, R. L.; Sekowski, A.

Nutrition Reports International 14 (1) 25-32 (1976) [16 ref. En] [Bureau of Biol. Res., Rutgers Univ., New Brunswick, New Jersey, USA]

A bioenergetic rapid method for detection of contamination of foods is described. The method is based on measurement of the energy consumption required for a specified increase in body wt. The method was evaluated in a 12-day study using young chicks fed diets containing 0, 61, 122, 183 or 244 ppm Cd. The results show that during the first 3 days of the experiment, chicks fed Cd-containing diets required less dietary energy than those fed the control diet. During the rest of the experimental period, energy requirement for 100 g wt. gain was correlated with dietary Cd concn. Data are also given for the Cd, RNA, DNA, protein and amino acid contents of the livers and hearts of chicks receiving the various diets. AJDW

74

[Analysis of cadmium in foods.] Zur Analyse von Cadmium in Lebensmitteln.

Woidich, H.; Pfannhauser, W.

L und E 28 (3) 81 (1975) [De] [Forschungsinst. der Ernährungswirtschaft, Blaasstrasse 24, A-1190 Vienna, Austria]

The photometric and atomic absorption spectrophotometric (AAS) method of detn. of Cd in foods were compared. At concn. of about 0.5 ppm, relative SD for the 2 methods were 8.17 and 2.58% and recoveries of added Cd from fish were 99.45 and 97.93%. Mean Cd contents in cereals, fish, shellfish and pork were 0.014-0.024 ppm, with a total range of 0.006 (wheat)-1.93 (oats). RM

75

[Analysis of heavy metals in foods: problems of recovery.] Das Problem der Rückgewinnung bei der Analyse von Schwermetallen in Lebensmitteln. [Review]

Pfannhauser, W.

L und E 28 (4) 101-102 (1975) [De] [Forschungsinst. der Ernährungswirtschaft, Blaasstrasse 24, A-1190 Vienna, Austria]

76

Heavy metal exposure from foods.

Mahaffey, K. R.; Corneliussen, P. E.; Jelinek, C. F.; Fiorino, J. A.

Environmental Health Perspectives No. 12, 63-69 (1975) [5 ref. En] [FDA, 200 C Street S.W., Washington, DC 20204, USA]

The FDA has a continuing programme of monitoring foods for their content of Pb, Cd, Hg, Zn, As, and Se to determine trends of increasing or decreasing levels. The monitoring protocol is that of the Total Diet Study, in which 'market baskets' of typical foods and beverages consumed by 15-20-yr-old American males are collected in various

geographical locations at regular intervals during the yr, divided into food classes, composited, and analysed. Cd has the most widespread distribution of the 6 heavy metals and Hg the most limited. The analytical values for Pb may be underestimated because of limitations of the methodology; these do not apply to the other 5 elements. A tabulation by yr shows that the levels of these elements in foods do not vary significantly from one yr to the next. Average intakes of Pb, Cd, and Hg are below the WHO/FAO tolerable intakes for adults; such tolerable intakes have not been established for As and Se. Increases in concn. of these elements in foods would be considered undesirable, however. AS

77

[Basic questions on the production of wholesome foods. III. Effect of compost prepared from municipal wastes and of sewage sludge on the heavy metal content of edible plants.]

Grundsatzfragen zur Erzeugung einer gesunden Ernährung. III. Einfluss von Müllklärschlammkompost und Klärschlamm auf den Schwermetallgehalt von Nahrungspflanzen. [Lecture]

Schmid, G.; Rosopulo, A.; Weigelt, H.

Landwirtschaftliche Forschung Sonderheft 31/II, 191-205 (1975) [12 ref. De, en, fr] [Bayerische Landesanstalt für Bodenkultur & Pflanzenbau, Munich, Federal Republic of Germany]

Field trials were performed with sewage sludge and compost from municipal wastes applied at 100-2000 m³/ha. Effects on uptake of Mn, Cu, Zn, Pb, Cd, Cr and Hg were studied in sugar beets, potatoes summer and winter wheat, barley and oats. Tabulated results showed that in comparison with untreated controls, uptake of Mn was reduced by about 50% and Cr uptake was increased by >100% while, with few exceptions, the uptakes of other metals showed no significant changes. Since no legal tolerances have been established by the Federal Health Office, no statement can be made on the harmful effect of the observed metal concn. [See FSTA (1976) 8 9P1680 for part II.] RM

78

The implication of the transfer of trace metals from sewage sludge to man. (In 'Trace substances in environmental health - VIII' [see FSTA (1976) 8 12A698].) [Lecture]

Nelmes, A. J.; Buxton, R. S. J.; Fairweather, F. A.; Martin, A. E.

pp. 145-153 (1974) [26 ref. En] [Div. of Environmental Pollution & Chem. Contamination of Food, Dep. of Health & Social Security, Alexander Fleming House, London, UK]

25 trace elements have been detected in sewage sludges, and of these Pb and Cd are of particular importance in relation to the extent to which they may constitute a hazard to health (by direct or indirect transfer to man). The trace metal content of sludges depends on both the quantity and quality of domestic sewage and industrial effluent; after

deposition on soil, their availability to plants and groundwater varies with the physical and chemical properties of the soil. Pb and Cd were found to accumulate in farm soil heavily treated with sewage and undigested sludge but not in grassland regularly receiving low doses of liquid sludge. Pb and Cd may reach man via food of either animal or vegetable origin. The contribution of these toxic metals to the total dietary intake of man in England and Wales is at present considered to be acceptably low. Studies on cattle grazed on sludge-treated pastures did not show a significant increase in the total Pb or Cd content of milk or muscle when compared with samples from cattle fed untreated pasture. The liver Pb and Cd content of cattle from treated pastures did not indicate that this meat was unfit for human consumption. AS

79

Effect of a smelter on the agricultural conditions in the surrounding environment. (In 'Trace substances in environmental health - VIII' [see FSTA (1976) 8 12A698].) [Lecture] Lagerwerff, J. V.; Brower, D. L. pp. 203-212 (1974) [32 ref. En] [Agric. Environmental Quality Inst., USDA, Beltsville, Maryland, USA]

Samples of human blood and hair, animal blood and milk, home-produced vegetables and house dust were gathered and analysed for Pb and Zn and in a few instances for Cd. The samples were drawn from areas of both high and low exposure to fallout from a smelter. The Pb content was significantly (P > 0.95) higher in home produce, milk and human and animal blood in high than in low exposure areas. Cd followed a similar trend in produce and house dust. It is conservatively estimated that persons living in the area of high exposure ingested Pb and Cd at rates >50% above those associated with 'normal' dietary intake of these metals. [See also FSTA (1976) 8 7C329.] AS

80

[Heavy metal content in sediment samples taken from a drinking-water reservoir.] Untersuchungen über den Schwermetallgehalt im Sediment einer Trinkwassertalsperre.

Mihm, U.; Botzenhart, K.; Noeske, K.

Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, 162 (1/2) 205-210 (1976) [5 ref. De, en] [Hygiene-Inst., Univ. Bonn, Bonn, Federal Republic of Germany]

Sediment samples from the preliminary catchment basin of the Wahnachtal reservoir were analysed for heavy metals (Fe, Zn, Mn, Pb, Cu, Cr, Cd). The upper (i.e. most recent) layers of sediment contained increased concn. of Zn, Mn, Pb, Cu, and Cd; this increased heavy metal concn. is attributed to Zn and Pb ores in the catchment area. The possibility of re-mobilization of heavy metals in these sediments and their liberation into the drinking water supply is briefly considered.

AJDW

81

Lead, cadmium, zinc, copper and nickel distributions in vegetables and soils of an intensely cultivated area and levels of copper, lead and zinc in the growers. (In 'Trace substances in environmental health - VIII' [see FSTA (1976) 8 12A698].) [Lecture]

Hutchinson, T. C.; Czuba, M.; Cunningham, L. pp. 81-93 (1974) [10 ref. En] [Dep. of Bot., Univ. of Toronto, Toronto, Ontario, Canada]

A study was made of an intensively cultivated horticultural area, in production for <40 yr since the drainage of the marsh from which it was formed. The muck soil varies in depth from 6 to 30 ft. Heavy applications of fertilizer and pesticides maintain high productivity. Distribution of trace heavy metals (Pb, Cd, Ni, Cu, Zn) in the soils, crops and people was studied. The effect of cultivation practices on metal accumulation was determined by comparisons with undrained parts of the marsh. Marked soil profile effects were seen for all metals, especially for Cu. Crop levels revealed that Cu was relatively tightly held in the organic soil compared with the other metals. Tabulated data give the concn. of each metal in leaves, roots, and, where appropriate, heads, tubers, flowers, grains and bulbs of lettuces, celery, cauliflowers, cabbages, oats, corn, radishes, potatoes, parsnips, carrots and onions harvested in spring and autumn. Metal concn. were higher in spring and autumn. Metal concn. were higher in spring than in autumn. Leafy crops, especially lettuce and celery, accumulated more Pb and Cd than did root crops. Pb levels were above normal. Fertilizers appeared to be a potential source of contamination. JA

82

Metal ion removal.

Danesh, A.

United States Patent 3 958 022 (1976) [En]

Heavy metal ions are removed from sea-food by washing with a complexing agent, followed by heating to volatilize the heavy metal ions. IFT

83

[Suitability of shellfish for processing. II. Seasonal changes in heavy metal content of baby clam.]

Lee, E. H.; Ryu, B. H.; Yang, S. T.

Bulletin of the Korean Fisheries Society 8 (2) 85-89 (1975) [8 ref. Ko, en]

Heavy metal content of baby clams from March 1973 to April 1974 in Depori, Samchunpo, Korea showed irregular monthly changes of Hg, Pb, Cu and Cd, but was relatively high in the summer season. Contents ranged as follows (ppm): Hg, 0.003-0.038; Pb, 0.096-0.921; Cu, 0.023-0.139; and Cd, 0.009-0.038, and the clams were considered suitable for processing. [From En summ.] VJG

84

Heavy metal and chlorinated hydrocarbon residues in California sea lions (*Zalophus californianus californianus*).

Buhler, D. R.; Clacys, R. R.; Mate, B. R.

Journal of the Fisheries Research Board of Canada 32 (12) 2391-2397 (1975) [27 ref. En, fr] [Dep. of Agric. Chem. & Environmental Health Sci. Cent., Oregon State Univ., Corvallis, Oregon 97331, USA]

Samples of various tissues and organs from sea lions collected along the central Oregon coast in 1970, 1971 and 1973 were analysed for total Hg, methylmercury, Cd and chlorinated hydrocarbons. Max. Hg concn. 74-170 ppm occurred in the liver but only 1.6-3.7% of this was present as methylmercury. Cd (7.2-12.0 ppm) was concentrated primarily in the kidney. Chlorinated hydrocarbon residues in sea lion fat ranged between 253 and 475 ppm DDE and 21.2 and 34.1 ppm PCB. VJG

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FAB 37

CADMIUM IN FOODS

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H. BROOKES

ASSISTANT EDITOR

1

[Comparative study of the determination of cadmium in water, fertilizers and plants using differential pulse polarography and atomic absorption spectrometry.]

Beaufays, J. M.; Nangniot, P.

Analusis 4 (5) 193-199 (1976) [8 ref. Fr, en]

[Fac. des Sci. Agron. de L'Etat, Gembloux, Belgium]

The methods for determining Cd in an agricultural or biological context are largely restricted to 2 currently favoured techniques: differential pulse polarography and AAS. It is shown that these 2 techniques are equivalent, the choice depending on the basic equipment and financial resources of the laboratory concerned. Equipment and methods used are described and results shown in diagrams and tables. Concn. of Cd found were 0.02-0.20 µg/l. in mineral water, and 3.41 in tap water (WHO tolerance for drinking water 10 µg/l.). Good correlation was also found between results (by AAS) for samples treated by wet or low temp. ashing. RM

2

[Atomic absorption spectrophotometric determination of lead, cadmium and copper in foods by simultaneous extraction of the iodides with methyl isobutyl ketone.]

Tsutsumi, C.; Koizumi, H.; Yoshikawa, S.

Japan Analyst [Bunseki Kagaku] 25 (3) 150-154 (1976) [11 ref. Ja, en] [Nat. Food Res. Inst., Min. of Agric. & Forestry, 1-4-12, Shiohama, Koto-ku, Tokyo, Japan]

Pb²⁺ (1-30 µg), Cu²⁺ (1-30 µg) and Cd²⁺ (0.2-6 µg) ions were quantitatively extracted as iodides from H₃PO₄ (4.25-5.0M) or H₂SO₄ (approx. 2.4M) solution containing KI (0.1-0.7M) with methyl isobutyl ketone (MIBK). The absorbance of PbI₂ after extraction with MIBK from acid solution containing 0.1M KI gradually decreased on standing, but showed little decrease when 0.7M KI was used and could be measured quantitatively even after one night. The simultaneous presence of 200 mg Ca²⁺, 100 mg Mg²⁺, 10 mg Fe³⁺, Mn²⁺, Zn²⁺ and Sn²⁺, 5 mg Cu²⁺, Pb²⁺, Cd²⁺ and a mixture of 5 mg each Fe, Cu, Mn and Zn had no effect on the extraction of metal iodides from H₃PO₄, but >50 mg Ca or >5.0 g NaCl in 55 ml of the acid solution reduced the amount of Pb I₂ extracted from H₂SO₄. Recoveries of Pb, Cu and Cd in ashed solutions of foods (brown rice, wheat flour, corn, fruit juices) were 101-105, 97-104 and 97-100% respectively. Coeff. of variation for standard solutions of 5-25 µg Pb, 5-25 µg Cu and 1-5 µg Cd were 2.12-0.31, 0.716-0.291 and 1.36-0.215%, relative SD for ashed solutions of food containing 26-28 µg Pb, 16-21 µg Cu and 2-5 µg Cd were 0.77-0.37, 0.49-0.35 and 0.62-0.45% respectively. The method is rapid and simple and is applicable to detn. of Pb, Cu and Cd in nearly all kinds of food. AS

3

[Dry ashing method for various foods for solvent extraction-atomic absorption spectrophotometry.]

Tsutsumi, C.; Koizumi, H.; Yoshikawa, S.

Japan Analyst [Bunseki Kagaku] 25 (3) 155-160 (1976) [7 ref. Ja, en] [Nat. Food Res. Inst., Min. Agric. & Forestry, 1-4-12, Shiohama, Koto-ku, Tokyo, Japan]

In the detn. of trace metals by solvent extraction/AAS the sample solution was prepared by dry ashing. Cereal grains and their flours (brown and polished rice, barley, wheat, corn) to which the standard solutions of Cd, Pb and Cu were added, were ashed at 490°C and 540°C. The ashes were acid and generally contained residual C which absorbed some of the heavy metals. The heavy metals absorbed on the residual C were not eluted with various acid solutions, but were completely recovered when the residual C was decomposed with small amounts of HClO₃ and HNO₃. Heavy metals were lost when fruits and vegetables were completely ashed at 490° or 540°C. In order to keep the ash acid, H₃PO₄ was added to fruit and vegetable samples before ashing. No loss of Cd, Cu or Pb occurred during dry ashing at 490°C. The anhydrous silica formed by dry ashing of barley did not absorb heavy metals if the acid solution was not filtered with filter paper. AS

4

Interrelationships between plant cadmium and uptake of some other elements from culture solutions by oats and lettuce.

John, M. K.

Environmental Pollution 11 (2) 85-95 (1976) [25 ref. En] [Sci. Policy Branch, Environment Canada, Ottawa, Ontario K1A 0H3, Canada]

Plant tissue concn., uptake and translocation of Cd to tops of hydroponically-grown oats and lettuce were most effectively reduced by increasing K supply or pH of contaminated solution. Cd in a specific tissue or crop was also significantly reduced when additional Ca, Zn, P or Al was supplied. Plant Cd may be influenced directly by availability of a nutrient, but changes in tissue concn. of other elements, i.e. effect of P on Zn or K on Ca, may indirectly affect plant Cd. Varying solution Cd and subsequent plant Cd levels significantly affected tissue P, Fe, Mn, Al and Ca and such changes may influence subsequent Cd uptake. The study indicated a complexity of elemental interrelationships and the resultant balance within plants influences plant Cd. AS

5

Differential effects of cadmium on lettuce varieties.

John, M. K.; Laerhoven, C. J. van

Environmental Pollution 10 (3) 163-173 (1976) [17 ref. En] [Office of the Sci. Advisor, Environment Canada, Ottawa, Ontario, Canada K1A 0H3]

9 varieties of lettuce grown in pots of sand were subjected to various treatment solutions (containing

0, 0.1, 0.5, 2, 10 or 50 ppm Cd) added to the nutrient solution. Cd concn. in lettuce tops was measured after 3 and 5 wk of exposure, and shown to be dependent on var. as well as substrate Cd; results are tabulated. Relative Cd concn. in tops (% of mean for all varieties) showed that var. New York 12 contained least Cd and accumulated only 65% of the concn. averaged over all varieties; 2 other head lettuce var. (Great Lakes 659 and Penn Lake) accumulated lower than average concn.; leaf varieties Early Prize Head and Salad Bowl were average; Paris White cos was above average; and greatest Cd concn. occurred in the head lettuce var. Great Lakes 428. AL

6

[Effect of refining on the concentration of trace metals in oils and fats.] Der Einfluss der Raffination auf die Konzentration von Spurenmetallen in Ölen und Fetten. [Lecture] Thomas, A.

Fette, Seifen, Anstrichmittel 78 (4) 141-144 (1976) [12 ref. De, en] [F. Thörl's Vereinigte Harburger Oelfabriken, 1. Hafenstrasse 15, 2100 Hamburg 90, Federal Republic of Germany]

The published concn. of trace metals in edible oils and fats vary considerably, due both to differences in samples and methods of analysis. The detn. of As, Pb, Cd and Hg in 94 samples of crude oils (coconut, groundnut, olive, palm, rapeseed, soybean, sunflower) and fats (tallow, lard) showed that the limits of concn. proposed in German draft legislation of May 1974 were frequently exceeded for Pb and Hg. Normal refining reduced Pb concn. to <0.15 ppm (proposed limit), but the 0.025 ppm limit for Hg was exceeded in 33% of 3 coconut oil samples and 17 refined soybean oil samples. Examination of individual refining steps showed that the main reduction of Pb content took place during neutralization. RM

7

Mercury and cadmium concentrations in milk in Puerto Rico.

Cheliapan, S.; Pedersen, K. B.; Plaza, H. *Journal of Radioanalytical Chemistry* 32 (1) 173-178 (1976) [11 ref. En] [Univ. of Puerto Rico & Puerto Rico Nuclear Cent., Puerto Rico]

Milk was collected over a 4-month period from 3 representative areas of Puerto Rico. The samples were analysed for Hg and Cd contents using instrumental neutron activation analysis (INAA). Mean values for Hg generally ranged from 0.042 to 0.059 ppm; one exceptionally high mean monthly value of 0.080 ppm was noted in 1 area. These values are slightly higher than the safe upper limit set by the WHO [no values or reference given]. Mean Cd values ranged from 0.126 to 0.344 ppm. Lower values were found in 9 milk samples analysed by AAS (0.01-0.06 ppm). The authors suggest that the precision of the INAA method may be improved by an extraction of the Cd before counting. MEG

8

Mineral composition of liver and kidney of rats fed corn, sorghum, and soybean grain grown with sewage sludges and NPK fertilizers.

Miller, J.; Boswell, F. C.

Journal of Agricultural and Food Chemistry 24 (5) 935-938 (1976) [9 ref. En] [Dep. of Food Sci., Univ. of Georgia Agric. Exp. Sta., Georgia Sta., Experiment, Georgia 30212, USA]

Corn, sorghum and soybeans were grown to maturity on soils which had been treated with NPK fertilizers or with low or high levels of sewage sludge known to be high in heavy metals. Grains from the mature plants were analysed for N (Kjeldahl method), tanning, P, K, Mg, Mn, Fe, Zn, Cu, Cr, Cd, Ni and Pb. Results are detailed in tables. Weanling rats were fed the grains and a study made of the heavy metal concn. in tissues (liver and kidney). Differences in tissue composition associated with type of soil treatment were found only for Mn, Cu and Fe and even for these elements, levels in tissues were within normal ranges. Measurable quantities of Cd, Ni and Pb were not found in grains or tissues; Cr was found in trace amounts in grains but not in tissues. JA

9

[Pollution of well water with heavy metals in the Tokyo metropolitan area.]

Takahashi, Y.; Ohashi, N.; Kowase, T.; Yamazaki, K.; Mimura, S.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 26 (1) 323-328 (1975) [2 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo 160, Japan]

Surveys have been made of the extent of pollution by harmful heavy metals (e.g. Cu, Cd, Cr, Zn, Ni, Pb) in the water in wells situated near factories in the Tokyo metropolitan area. Highest pollution was found in the Shimura, Akabane and Tamagawa districts. Source of the heavy metals is generally considered to be effluent discharged from metal-plating factories. [From En summ.] JA

10

[Radiometric determination of increase in Cd content of endosperm after Cd fertilization of soil.]

Radiometrischer Nachweis der Cadmium-Anreicherung im Mehlkörper des Weizenkornes nach Cadmium-Zufuhr zum Boden.

Oberländer, H.-E.; Roth, K.

Naturwissenschaften 63 (10) 483 (1976) [3 ref. De] [Landwirtschaftlich-chem. Bundesversuchsanstalt, Vienna, Austria]

Summer wheat was grown in pot experiments in 2 different soils to which 0.5 ppm labelled Cd (as sulphate) was added (equivalent to 5× the Cd added by fertilization with 300 m³ clarification slime (2% TS, 50 ppm Cd in DM)/ha). The contents of Cd were determined radiometrically in various parts of the cereal, including (pp. in DM): whole grain, 0.11-1.10; bran, 0.23-2.75; and flour, 0.066-0.55. The lower contents were always in soil particularly suited to growth of summer wheat. HBr

11

[Study of trace elements in marine fish. II. Distribution of heavy metals in bonito tissue.] Katsuki, Y.; Yasuda, K.; Ueda, K.; Kimura, Y. *Annual Report of Tokyo Metropolitan Research Laboratory of Public Health* 26 (1) 196-199 (1975) [11 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo 160, Japan]

8 freshly caught bonitos, 59-65 cm long, obtained from Japanese coastal waters, were studied for the distribution of heavy metals in their organs and muscles. Mn, Pb, Co, Cd, Cu, Cr, Zn and total and methyl Hg were determined by AAS and GLC. Results are tabulated [in English]. Heavy metal concn. were constant and not affected by body size, season of catch or fishing area. Total Hg tended to accumulate in muscles rather than in organs; about 90% was present as methyl Hg. [From En summ.] [See FSTA (1976) 8 9R556 for part I.] JA

12

[Contents of metals in fish from Finnish waters and in commercial canned fish products.]

Karppanen, E.; Stabel-Taucher, R. *Suomen Eläinlääkäri-lehti* 82 (6) 277-284 (1976) [9 ref. Fi, sv] [Valtion Eläinlääketieteellinen Laitos, Helsinki, Finland]

The Pb, Cd, Cu and Zn contents of 245 samples of fresh fish from waters off the coast of Finland and of 53 samples of canned fish products imported into Finland were determined by AAS. Results are tabulated. Ranges found for the fresh fish and fish products, respectively, were: (mg/kg) Pb, 0.13-0.243 and 0.030-3.0; Cd, 0.0009-0.1608 and 0.0030-0.1433; Cu, 0.07-2.26 and 0.10-17.00; and Zn, 2.1-46.2 and 3.9-10.0. The Sn contents of the canned fish ranged from 4 to 180 mg/kg. The type of fish and the time and place of the catch had a considerable effect on the results. HBr

13

[Heavy metals in meat. Considerations from the European point of view.] *Schwermetallgehalte im Fleisch - eine Betrachtung aus europäischer Sicht.* (In 'Rückstände in Fleisch und Fleischerzeugnissen' [see FSTA (1977) 2S164].) [Lecture] Musche, R.

pp. 124-129 (1975) [2 ref. De, en] [Max von Pettenkofer-Inst., 1 Berlin (West) 33]

Problems of heavy metals in meat are discussed, with special reference to EEC legislation. Aspects considered include: contaminated feeds as a source of heavy metals in meat; tolerances for heavy metals in meat; and heavy metal (As, Sb, Pb, Cd, Cr, Fe, Co, Cu, Mo, Hg, Se, Sn, Zn) concn. in meat and offal in various countries (with reference to tables of data). AJDW

14

Interactions of selenium, cadmium and copper in sheep.

Leë, H. J.; Jones, G. B. *Australian Journal of Agricultural Research* 27 (3) 447-452 (1976) [11 ref. En] [Div. of Human Nutr., CSIRO, Adelaide, South Australia 5000, Australia]

The effects of Cd supplementation of the diet (with 0, 7.5 or 15 mg Cd/day, as CdCl₂) and administration of Se rumen pellets (0, 1 or 4) on the Se and Cd concn. in muscle, liver and kidney tissue, and the Cu concn. in the liver were studied. The sheep were slaughtered 201 days after the start of the experiment. The results show that Se concn. in all 3 tissues increased with increasing number of Se pellets administered, but was not influenced by Cd supplementation of the diet. Cd concn. in all 3 tissues increased with increasing Cd supplement level, but was not significantly influenced by Se supplements. Cd supplements reduced the deposition of Cu in the liver; Se pellet administration did not counteract this trend. AJDW

15

Analysis for copper, iron, and cadmium in plant materials by atomic absorption spectroscopy - a critical evaluation and comparison with accepted AOAC colorimetric methods.

Boline, D. R.

Dissertation Abstracts International, B 37 (2) 727: Order no. 76-17106 (1976) [En] [Kansas State Univ., Manhattan, Kansas 66502, USA]

16

[Results of food control in Switzerland in 1975.]

Die Durchführung der Lebensmittelkontrolle in der Schweiz im Jahre 1975.

Switzerland, Eidgenössisches Gesundheitsamt, Abteilung Lebensmittelkontrolle

Mitteilungen aus dem Gebiete der Lebensmitteluntersuchung und Hygiene 67 (3) 271-366 (1976) [De, Fr]

Results of control of a very wide range of foods and food constituents carried out by the Swiss public health authorities during 1975 is presented in a series of detailed tables showing data from the analysis of approx. 190 000 samples of 63 foods, groups of foods, additives or adjuvants. Microbiological aspects and presence of heavy metals and pesticide residues are given particular emphasis. [See FSTA (1976) 8 7A367 for 1974 report.] HBr

17

Simple apparatus for trace analysis of toxic heavy metals. Determination of cadmium and lead by manual D. C. polarography.

Hsieh, S. A. K.; Wong, G. J. K.; Ma, T. S.

Mikrochimica Acta II (3/4) 253-263 (1976) [24 ref. En, de] [Dep. of Chem., Univ. of Singapore, Singapore 10]

A simple manual d.c. polarographic apparatus is described which can be assembled from ordinary laboratory equipment. The method of analysis is based on classical polarography. The sensitivity of this apparatus can reach ± 0.5 mV and ± 0.005 μ A. Trace amounts of Cd and Pb in foods and beverages can be determined in the ppm region: min. quantity of Cd determined is 0.17 ppm, that of Pb is 0.3 ppm. RM

18

Epidemiological studies on cadmium in the environment in Japan: etiology of itai-itai disease. [Lecture]

Tsuchiya, K.

Federation Proceedings 35 (12) 2412-2418 (1976) [22 ref. En] [Dep. of Preventive Med. & Public Health, School of Med., Keio Univ., Tokyo, Japan]

A section of this review discusses environmental pollution by Cd in Japan and gives data on the levels of Cd found in drinking water and in rice. The average Cd concn. in a total of 892 samples of unpolished rice was 0.332 ppm; the max. level found was 3.22 ppm. 36 samples contained >1.0 ppm, which is the food sanitation standard for Cd in Japan. The highest Cd concn. in drinking water was 0.064 ppm, with an average level of 0.022 ppm; the standard for Cd in drinking water in Japan is 0.01 ppm. The main dietary source of Cd in Japan is rice. JA

19

[Lead and cadmium contents of baby foods and their toxicological significance.] Über die Blei- und Cadmiumgehalte von Kleinkindernahrung und ihre lebensmittelhygienisch-toxikologische Bedeutung. Woggon, H.; Jehle, D.

Nahrung 20 (8/9) 807-815 (1976) [11 ref. De, en, ru] [Zentralinst. für Ernährung, Potsdam-Rehbrücke, German Democratic Republic]

A total of >150 samples of 'Fur's Kind' brand baby foods (manufactured in the German Democratic Republic) were analysed for Pb and Cd. The results show that all samples except spinach contained <100 μ g Pb/kg. All samples contained <10 μ g Cd/kg, except for liver-containing products which contained 25-50 μ g Cd/kg. Dried milk products contained no Cd. The average daily intake of Cd and Pb by infants fed these foods is calculated; the intake of Cd and Pb/kg body wt. is at least equal to that of adults. IN

20

[Lead, cadmium and zinc in fruit and vegetables.]

Fuchs, G.; Haeggelund, J.; Jorhem, L.

Var Foeda 28 (6/7) 160-167 (1976) [9 ref. Sv, en] [Statens Livsmedelsverk, 751 26 Uppsala, Sweden]

Pb, Cd and Zn were determined by AAS in a total of 265 samples of Swedish-grown and 190 samples of imported fruit and vegetables. Detailed tables of mean values and ranges for Pb, Cd and Zn concn. are given together with Zn:Cd ratios. Max. values recorded were (mg/kg): Pb 0.288 (in apples); Cd 0.160 (in carrots); and Zn 17.84 (in spinach). The contribution of fruit and vegetables to the daily intakes of these heavy metals is discussed. AJDW

21

Lead and cadmium in California raw milk.

Bruhn, J. C.; Franke, A. A.

Journal of Dairy Science 59 (10) 1711-1717 (1976) [18 ref. En] [Cooperative Extension & Dep. of Food Sci. & Tech., Univ. of California, Davis, California 95616, USA]

An AAS procedure for the simultaneous measurement of Pb and Cd in raw whole milk has been developed and tested. A 100 g sample is dry ashed at a temp. 425°C . The ash is dissolved in HCl and neutralized with NH_4OH to pH 8.5 in the presence of ammonium citrate. KCN is added (to complex interfering ions) followed by addition of ammonium pyrrolidino-carbodithioate to complex Pb and Cd. The complexes are extracted with isoamyl acetate and the Pb and Cd measured by AAS. Mean recoveries of Pb and Cd added to raw whole milk were $92.1 \pm 2.9\%$ and $97.5 \pm 2.5\%$, respectively. A statewide survey showed that the mean concn. of Pb in 350 raw milk samples was 91 $\mu\text{g/kg}$; 222 of the samples contained <100 $\mu\text{g/kg}$. The mean concn. of Cd in 315 raw milk samples was 6.0 $\mu\text{g/kg}$; 40 samples contained 1.0 $\mu\text{g/kg}$, and 255 samples <10.0 $\mu\text{g/kg}$. AS

22

[Trace amounts of heavy metals in poultry and eggs.] [Review]

Szabo, A.

0128af 22 (10) 444-449 (1975) [15 ref. Hu] [Megyei Elelmiszerell. es Vegyvizsg. Intezet, Győr, Hungary]

23

[Contamination of foods with toxic elements.] [Lecture]

Cotta-Ramusino, F.

Bollettino dei Laboratori Chimici Provinciali 26 (1) 37-41 (1975) [5 ref. It, fr, en, de] [Istituto Superiore di Sanita, Rome, Italy]

Sources of contamination, max. acceptable levels in foods and methods used by the Istituto Superiore di Sanita for determining Pb, Hg and Cd in foods are briefly discussed. Tabulated data give the mean, min. and max. levels of Hg found in 14 different foods; the highest level found was in tomato concentrate (0.022 mg/kg). [See FSTA (1977) 9 4C140.] RM

24

Effects of sewage sludge composition, application rate, and lime regime on plant availability of heavy metals.

John, M. K.; Laerhoven, J. van

Journal of Environmental Quality 5 (3) 246-251 (1976) [15 ref. En] [Environment Canada, Fontaine Building, Ottawa, Ontario, K1A 0H3, Canada]

Concn. of Cd, Zn, Pb, Ni, Mn and Fe were determined in lettuce leaves (*Lactuca sativa* L. var. *longifolia*) and in tops and tubers of beet (*Beta vulgaris* L.) grown on limed (pH 6.4) and unlimed (pH 5.6) silt loam treated with primary digested sewage sludge or a commercial heat-dried activated sludge ('Milorganite'). Concn. of heavy metals were not simply or solely dependant on heavy metal contamination of the soil, but varied considerably with rate of sludge application, lime regime, soil pH and time of exposure. JRR

25

[Recent studies of the heavy metal content of mushrooms.] [Review]

Quinche, J.-P.

Revue Suisse d'Agriculture 8 (5) 148-149 (1976) [4 ref. Fr]

This brief review surveys recently published work on the heavy metal content of various mushroom species. Data are given on the Hg, Pb, Cd and Se contents of *Agaricus* spp. from the Geneva area of Switzerland, Amsterdam and Paris and on the Hg content of various species from southern Germany. Mention is also made of an outbreak of food poisoning in the Montbeliard region caused by *Psalliota bispora* contaminated with a triazine herbicide. JA

26

[Determination of copper, lead, cadmium and zinc contents of milk by atomic absorption spectrophotometry.]

Tsvetkova, Ts.; Sergeeva, D.; Koen, E.

Veterinarnomeditsinski Nauki 13 (7) 28-34 (1976) [22 ref. Bg, ru, en] [Vet. Inst. po Zarazni i Parazitni Bolesti, Sofia, Bulgaria]ilia, Italy]

Samples of milk from each of 7 different areas of Bulgaria (127 samples in all) were examined during 1972-1974 using a model AA-5 Varian-Tektron instrument. The ranges (mg/kg) were: Cu (33 samples), 0.107-0.253; Pb (33 samples), 0.127-0.495; Cd (41 samples), 0.108-0.164; and Zn (20 samples), 3.96-5.51. SKK

27

The relation between the concentration of some main elements and the stages of maturation of ovaries in cod (*Gadus morrhua*).

Julshamn, K.; Braekkan, O. R.

Fiskeridirektoratets Skrifter Serie Ernaering 1 (1) 1-15 (1976) [12 ref. En] [Inst. of Vitamin Res.,

Directorate of Fisheries, Bergen, Norway]

Samples of cod roes at various stages of the reproductive cycle were collected during Jan.-March 1974, and analysed for DM, Na, K, Ca, Mg, Fe, Mn, Zn, Cu, Co, Pb, Cd, Hg and vitamin B₁₂. Tables and graphs of results are given, broken down by stage of the reproductive cycle. DM concn. ranged from 17.7 to 30.1%. Concn. of all the elements studied varied considerably during the reproductive cycle. Interrelation of concn. of individual elements is discussed. Co concn. calculated as a constituent of vitamin B₁₂ correlated closely with total Co concn. Max. recorded Pb, Cd and Hg concn. were, respectively, (µg/g roe, wet wt. basis): 0.98; 0.05; and 0.041. These values are well below the FAO/WHO max limits for heavy metals in foods. AJDW

28

[Determination of heavy metals in foods.]

Tsutsumi, C.

Journal of Japan Oil Chemists' Society [Yukagaku] 25 (10) 629-637 (1976) [88 ref. Ja] [Nat. Food

Res. Inst., Min. of Agric. & Forestry, 1-412 Shiohama, Koto-ku, Tokyo, Japan]

29

[Determination of Cu, Zn, Pb, Cd, Ni and Cr in vegetables, fertilizers, soils and water by X-ray fluorescence analysis.] Untersuchungen über die Bestimmung von Kupfer, Zink, Blei, Cadmium, Nickel und Chrom in Pflanzen, Böden,

Düngemitteln und Wasser mit Hilfe der Roentgenfluoreszenzanalyse. [Lecture] Rethfeld, H.; Grössmann, G.; Egels, W.

Landwirtschaftliche Forschung Sonderheft 32/I, 251-265 (1976) [4 ref. De, en, fr] [Landwirtschaftliche Untersuchungs- & Forschungsanstalt, von Esmarchstrasse 12, D-4400 Münster, Federal Republic of Germany]

The analysis of heavy metal traces in agricultural materials is described. Plant material is dried, crushed and pelletized. This simple sample preparation allows very fast and accurate analysis. To investigate matrix effects, 32 different matrices (including cereal grains, fruits and vegetables) were analysed. Slope and background for the different calibrations were determined. Result of these investigations is an amalgamation of matrices of the same kind into matrix groups. [See FSTA (1977) 9 5G327.] AS

30

[The dangers of environmental pollution by cadmium.] [Review]

Truffert, L.

Annales des Falsifications et de l'Expertise Chimique 69 (741) 465-472 (1976) [26 ref. Fr] [Lab. Cent. de la Prefecture de Police, Paris, France]

This review discusses Cd sources (e.g. metal refineries), absorption of Cd by humans (from, e.g.

foods and beverages), Cd metabolism in man, itai-itai disease in Japan (thought to be caused by rice contaminated with Cd), and mode of action of Cd in man. JA

31

[Study of the contamination of foods by cadmium. I. Liberation of cadmium from tableware.]

Laugel, P.; Wencker, D.; Weill, B.; Hasselmann, M.

Annales des Falsifications et de l'Expertise

Chimique 69 (741) 473-487 (1976) [8 ref. Fr]

[Lab. de Chimie Analytique et Bromatologie, Univ. Louis-Pasteur, Strasbourg, France]

Tests used in various countries for measuring the liberation of Cd from tableware and legal limits on Cd liberation are briefly discussed. Studies carried out in France on the liberation of Cd from ceramic tableware are reported in detail and the relevance of using acetic acid as a test compound in assessing Cd liberation is discussed. Brief consideration is also given to Cd liberation from plastics food containers, kitchen utensils made of enamelled metal and cast iron, and decorated glass. Proposed EEC legislation on Cd liberation from ceramic tableware intended for food use is discussed. JA

32

[Study of the contamination of foods by cadmium. II. Results of a regional investigation on various groups of foods.]

Laugel, P.; Wencker, D.; Weill, D.; Hasselmann, M.

Annales des Falsifications et de l'Expertise

Chimique 69 (741) 489-495 (1976) [25 ref. Fr]

[Lab. de Chimie Analytique et Bromatologie, Univ. Louis-Pasteur, Strasbourg, France]

Using an AAS method very similar to that adopted by the AOAC [FSTA (1973) 5 11C324], a study was made of the Cd content of a total of 272 food samples from various regions of France. The foods included meat and meat products, fish and fish products, shellfish, milk and dairy products, infant foods, fruits and vegetables, soups, beverages, cereals and cereal products, vinegar, mustard, spices, fats, sugar, honey, snails, eggs, colorant for meat, and marine algae. Max., min. and mean Cd levels found are tabulated. Mean levels ranged from 0.0047 µg/100 g in milk (12 samples) to 48.15 µg/100 g in porcine liver (6 samples). JA

33

The role of the quality of soil organic matter in cadmium accumulation in plants [radishes].

Jaakkola, A.; Ylärinta, T.

Journal of the Scientific Agricultural Society of Finland 48 (4) 415-425 (1976) [6 ref. En, fi]

[Agric. Res. Cent., Dep. of Agric. Chem. & Physics, 01300 Vantaa 30, Finland]

34

[Basic problems in production of healthy foods. IV. Heavy metal contents of vegetables. Reasons and possibilities of reducing contaminations.]

Grundsatzfragen zur Erzeugung einer gesunden Ernährung. IV. Schwermetallgehalte in Gemüse. Ursachen und Möglichkeiten zur Reduzierung der Belastungen. [Lecture]

Schmid, G.; Rosopulo, A.; Weigelt, H.

Landwirtschaftliche Forschung Sonderheft 32/1, 59-69 (1976) [9 ref. De, en, fr] [Bayerische Landesanstalt für Bodenkultur & Pflanzenbau, Menzingerstrasse 54, D-8000 Munich 18, Federal Republic of Germany]

The heavy metal contamination of produce from market gardens in the vicinity of airfields and roads was investigated during 3 seasons. Mn, Cu, Zn, Pb, Cd and Cr concn. were determined in root, leaf, fruit and bulb (onion-type) vegetables at distances of 10-100 m from roads, in relation to the frequency of flights and after cleaning and cooking. Tabulated results showed that leaf vegetables were the main group affected. Air traffic increased the toxic metal content above the normal concn. A mean increase of 11.5% Pb was observed between 100 and 10 m distance from roads, while Cd, Zn, Mn and Cu concn. were not affected. Normal preparation reduced the mean Pb concn. by 52-65% depending on the type of vegetable, Cr by 81-93%, Cd by 7-21%, Cu by 22-44%, Mn by 32-44% and Zn by 8-25%. [See FSTA (1976) 8 12C591 for part III; and FSTA (1977) 9 5G327.] RM

35

Atomic absorption spectrometric determination of some trace metals in fish meal and bovine liver by the solid sampling technique.

Langmyhr, F. J.; Aamodt, J.

Analytica Chimica Acta 87 (2) 483-486 (1976) [8 ref. En] [Dep. of Chem., Univ. of Oslo, Oslo 3, Norway]

Industrial fish meals (mackerel, blue whiting and capelin) and bovine liver were analysed by AAS, using solid sampling or atomization of liquid samples in the flame. Agreement between the two methods was satisfactory. Metal concn. ranges (ppm) in the fish meals were: Cd 0.13-0.40; Cu 3.4-5.0; Pb 0.60-1.5 and Mn 1.9-8.5. JRR

36

[Heavy metals in food.] Schwermetalle in Lebensmitteln. [Review]

Hertel, W.; Markard, C.

Gordian 77 (1) 8-10 (1977) [30 ref. De]

This review considers the toxic effects of Cd, Hg and Pb, their concn. in a range of animal and vegetable foods, possibilities of decontamination, and relevant Federal German regulations and recommendations. RM

37

Food surveillance in the UK.
Hubbard, A. W.

BNF Bulletin No. 19, 45-54 (1977) [10 ref. En] [Min. of Agric., Fisheries & Food, Great Westminster House, Horseferry Road, London SW1P 2AE, UK]

Surveillance of food for Pb and Cd contaminants is discussed. Figures are given for their contents in food groups in total diets, for Pb in brassicas and root crops grown near a metal refining plant, and for Pb pick-up by some fruits, vegetables and baked beans packed for 3 months in glass jars (Pb range 0.02-0.08 mg/kg), plain cans (0.11-0.50 mg/kg), and lacquered cans (0.15-1.05 mg/kg). AL

38

Distribution of lead and other metals in tea leaves, dust and liquors.

Michie, N. D.; Dixon, E. J.

Journal of the Science of Food and Agriculture 28 (2) 215-224 (1977) [5 ref. En] [Dep. of Ind., Lab. of the Gov. Chem., Cornwall House, Stamford Street, London SE1 9NQ, UK]

When samples of certain teas were analysed for Pb, repeat detn. made on the same samples showed a wide variation in the results. This was found to be due to dust particles, with a high Pb content, which were dispersed throughout the tea leaves. Further work showed that there was also more Fe, Zn and Cu in the dust than in the leaves. Analyses of tea prepared as for drinking showed that only a small amount of the Pb, Cd, Ni, Fe, Zn and Cu present in the leaves passed into the brew. The proportion of each metal extracted into the brew appeared to be independent both of the strength of brew and of the type of water used. Work with tannic acid solution indicated that soluble polyphenols could be responsible for complexing metals. AS

39

[Investigations into the lead and cadmium contents of meat and organ samples from poultry.]

Untersuchungen auf den Gehalt an Blei und Cadmium in Fleisch- und Organproben von Geflügel.

Holm, J.

Fleischwirtschaft 56 (11) 1649-1650 (1976) [4 ref. De, en, fr] [Staatliches Veterinäruntersuchungsamt, Dresdenstrasse 6, 3300 Braunschweig, Federal Republic of Germany]

The meat and in most cases the liver and kidney of 61 young fowls, 78 broilers and 53 boiling fowls were analysed for Pb and Cd by $\text{HNO}_3/\text{HClO}_4$ wet digestion and AAS. Tabulated results showed mean concn. (ppm) of: 0.007-0.009 Pb and 0.002 Cd in meat; 0.076-0.127 Pb and 0.063-0.701 Cd in kidney; and 0.032-0.100 Pb and 0.038-0.497 Cd in liver. Max. individual results were 1.183 and 1.307 ppm Pb and 1.911 and 4.545 ppm Cd, in kidneys of broilers and boiling fowls. RM

40

[Pb and Cd in meat and organs from slaughter cattle.] Untersuchungen über den Blei-(Pb) und Cadmium-(Cd) Gehalt in Fleisch und Organen von Schlachtrindern. [Lecture]
Kracke, W.; Kreuzer, W.; Sansoni, B.; Wissmath, P.

Proceedings of the European Meeting of Meat Research Workers No. 22, F1:1-F1:10 (1976) [39 ref. De, en, fr, ru] [Gesellschaft für Strahlen- und Umweltforschung mbH, D-8042 Neuherberg bei München, Federal Republic of Germany]

Samples of adductor muscle, liver and kidney from a total of 278 cattle of various breeds (0.8-15 yr of age) were collected in 1972-1975, and analysed by AAS for Cd and Pb. Mean values and ranges of values for Cd concn. were (ppm): muscle <0.005, no range given; liver 0.066 and <0.005-1.65; and kidney 0.311 and 0.008-1.95. Corresponding values for Pb were: muscle <0.05, no range given; liver 0.15 and 0.02-0.85; and kidney 0.34 and 0.10-2.00. The results were highly variable, especially for kidney tissue. Cd content of the kidneys tended to increase with increasing age of the animal. No effects of sex, breed or feeding method on the Cd or Pb concn. in the tissues studied were observed. The results are discussed in relation to literature data and proposed legal limits; interrelation of Cd and Pb concn. in the tissues studied is discussed. [See FSTA (1977) 9 6S988.] AJDW

41

[Lead and cadmium contents of herbs and spices.] Blei- und Cadmiumgehalt von Gewürzen.

Bielig, H. J.; Dreyer, H.; Askar, A.

Deutsche Lebensmittel-Rundschau 73 (2) 43-44 (1977) [8 ref. De, en, fr] [Inst. für Lebensmitteltech., Tech. Univ., Berlin (West)]

Cd and Pb were determined by AAS in commercial samples of various herbs and spices. Values for Pb were (ppm): (i) basil 2.65; (ii) savory (2 samples) 1.35 and 3.17; (iii) dill (2 samples) 2.44 and 2.70; (iv) tarragon 2.12; (v) marjoram 2.63; (vi) parsley (2 samples) 1.32 and 2.24; (vii) rosemary 2.78; (viii) thyme 3.03; (ix) caraway seeds 1.13; (x) paprika 1.44; (xi) white pepper 1.10; (xii) black pepper 0.34; (xiii) curry powder (3 samples) 2.35, 3.88 and 14.93; (xiv) cayenne pepper 4.50; (xv) cinnamon 1.10; and (xvi) vanilla pods 0.98. Corresponding values for Cd were, respectively (ppm): (i) 0.189; (ii) 0.188 and 0.242; (iii) 0.314 and 1.941; (iv) 0.335; (v) 0.281; (vi) 0.149 and 0.175; (vii) 0.305; (viii) 0.193; (ix) 0.138; (x) 0.203; (xi) 0.074; (xii) 0.071; (xiii) 0.073, 0.135 and 0.216; (xiv) 0.470; (xv) 0.363; and (xvi) 0.393. Only one sample (a curry powder) exceeded tolerances for heavy metals in foods in the Federal Republic of Germany. It is concluded that herbs and spices do not contain hazardous Pb or Cd concn. AJDW

42

Temperature-programmable furnace for ashing of foods in trace metal analysis.

Holak, W.

Journal of the Association of Official Analytical Chemists 60 (1) 239-240 (1977) [7 ref. En]
[FDA, 850 Third Avenue, Brooklyn, New York 11232, USA]

The use of a programmable furnace in preparing samples for determining Cd, Pb, Cu, and Zn by differential pulse anodic stripping voltammetry or AAS is convenient and time-saving. Recovery data for these 4 metals in various foods (tuna, sardines, milk) were 93-96% for 0.01-1 ppm Cd, 96-114% for 0.05-5 ppm Pb, 100-108% for 2-10 ppm Cu, and 97% for 10 ppm Zn. AS

43

Removal of mercury and cadmium ions from drinking water using powdered activated carbon.

O'Connor, J. T.; Badorek, D.; Thiem, L.

Abstracts of Papers, American Chemical Society 170, ENVT 19 (1975) [En] [Dep. of Civil Eng., Univ. of Missouri, Columbia, Missouri 65201, USA]

A laboratory investigation simulating removal of Hg and Cd from water by treatment with activated C was conducted to measure the effectiveness of the removal process. Chelating agents, because of their high degree of complexation with the metals and their high adsorption onto activated C, were added to improve removal. Cd removal by activated C alone reached a max. of 50% at a C dose of 100 mg/l. and pH 7, but rose to >90% with the addition of 0.017 mg/l. of EDTA at a C dose of 60 mg/l. Too high a concn. of EDTA interfered with the adsorption process. Removal of Hg by activated C alone at pH 7 was about 93% for C doses of 70 mg/l. or more and was not improved significantly by chelating agents at higher doses. Removals increased at the lower range of C doses (10-50 mg/l.) by 8-30% on addition of 1.7 mg/l. of EDTA. Important adsorption mechanisms for Hg and Cd ion removal may include the hydrolysis of activated surface oxides to form weak acid cation exchange sites as well as chemisorptive reactions between the ions and surface sulphido groups. AS

44

Zinc, copper, lead and cadmium contents in green tea.

Tsushida, T.; Takeo, T.

Journal of the Science of Food and Agriculture 28 (3) 255-258 (1977) [9 ref. En] [Nat. Res. Inst. of Tea, Kanaya-cho, Haibara-gun, Shizuoka Prefecture, Japan]

The levels of Zn, Cu, Pb and Cd in green tea were determined by AAS. During growth and development of tea shoots, Zn, Cu, Pb and Cd concn. decreased gradually. Some of the Pb in green tea was eliminated by washing with water before processing. The ranges and mean levels in 139 green teas were as follows: Zn 23.4-100.5 and

54.4 µg/g; Cu 4.7-36.5 and 11.4 µg/g; Pb 0.11-1.93 and 0.49 µg/g; and Cd 0.013-0.098 and 0.036 µg/g. Significant differences in the contents of Cu and Pb were observed between different districts in Japan. The green tea produced in districts near metropolitan areas contained the highest concn. of Pb. AS

45

[Determination of lead and cadmium in cereal and grass samples growing at varying distances from highways by flameless atomic absorption spectroscopy.] Bestimmung von Blei und Cadmium in Getreide- und Grasproben aus verschiedenen Entfernungen von Autostrassen mit Hilfe der flammenlosen Atomabsorptions-Spektroskopie.

Horak, O.

Landwirtschaftliche Forschung 29 (3/4) 289-298 (1976) [23 ref. De, en, fr] [Inst. für Landwirtschaft, Forschungszentrum, Seibersdorf, Austria]

A method described for detn. of Pb and Cd in grains and grass involves wet digestion of samples with a 5:1 mixture of nitric acid and perchloric acid, and measurement of Pb and Cd in the solution by flameless AAS with a graphite furnace. Pb content of grains of rye, wheat, barley and oats ranged from 0.11 to 4.36 ppm (DM basis) and was strongly dependent on traffic density. Highest levels were found in barley (3.95 ppm) and oats (4.36 ppm). Cd contents were generally low (20-82 parts/billion, DM basis) and not affected by traffic density. Highest levels were found in wheat (82 parts/billion). AS

46

Cadmium, lead and mercury contents of milk, evaporated milk, buttermilk and yoghurt in the Netherlands.

Ellen, G.; Tibbesma, G.

Netherlands Milk and Dairy Journal 30 (3/4) 174-185 (1976) [15 ref. En, nl] [Food Inspection Service for District of Friesland, Leeuwarden, Netherlands]

Analytical methods are described in detail for estimating the Cd, Pb and Hg contents of dairy products. After freeze-drying the samples, a temp.-programmed procedure for dry ashing up to 500°C was used for Cd and Pb analyses, followed by differential pulse anodic stripping voltammetry; for Hg analysis, the freeze-dried samples were digested with HNO₃ under pressure at 140°C in Teflon bombs, followed by cold vapour AAS detn. Analysis of 11 samples of pasteurized milk, 7 of canned evaporated milk, 15 of bottled evaporated milk, 5 of buttermilk and 5 of yoghurt (all originating from Netherlands dairy factories) showed that the Hg contents were below the detection limit of 0.5 µg/kg. Mean Cd contents were <0.5 µg/kg in all products except canned evaporated milk which contained 2.2 µg/kg. Mean Pb contents ranged from 4.1, 4.8 and 5.5 µg/kg in pasteurized milk, buttermilk and yoghurt

respectively to 13.4 µg/kg in bottled evaporated milk and 344 µg/kg in canned evaporated milk. MEQ

47

Heavy metal determination in sea water and in marine organisms with the aid of flameless AAS. IV. Description of a routine method for the determination of cadmium in small samples of biological material.

Sperling, K.-R.; Bahr, B.; Kremling, K. *Zeitschrift fuer Lebensmittel-Untersuchung und -Forschung* 163 (2) 87-91 (1977) [7 ref. En, de] [Biol. Anstalt Helgoland, Lab. Sülldorf, Wüstland 2, D-2000 Hamburg 55, Federal Republic of Germany]

An AAS method for Cd detn. is detailed under the following headings: equipment, precautions and pretreatment of equipment, reagents, collection of samples, preparation of samples and production of standard solutions, procedure of Cd detn., analysis of data, and special hints (optimization of measurement conditions, sources of error, intercalibration exercises, development of methods for other elements). JA

48

[Heavy metal and organohalogen compound contents in the seal *Phoca vitulina* from the German North Sea coast.] Ergebnisse über Schwermetall- und Organohalogenuntersuchungen am Seehund (*Phoca vitulina*) der deutschen Nordseeküste.

Huschenbeth, E.

Informationen fuer die Fischwirtschaft 24 (1) 18-20 (1977) [1 ref. De] [Inst. für Küsten- & Binnenfischerei, Hamburg, Federal Republic of Germany]

Data are given for a total of 63 seals collected during the period 1974-1976. Ranges of values for heavy metals in the liver were (mg/kg): Zn 27.0-56.0; Cu 2.6-17.0; total Hg 1.5-160.0; Cd 0.010-0.200; and Pb 0.10-0.57. Ranges of values for organochlorine compounds in belly fat were (mg/kg): polychlorinated 0.04-0.98; and dieldrin 0.04-0.90. The results are discussed in relation to literature data. AJDW

49

[Cadmium contents in meat, liver and kidneys of pigs for slaughter.] Cadmiumgehalte in Fleisch, Leber und Nieren von Schlachtschweinen.

Kreuzer, W.; Wissmath, P.; Hollwich, W. *Fleischwirtschaft* 57 (2) 267-270 (1977) [27 ref. De, en, fr] [Inst. für Hygiene & Tech. der Lebensmittel tierischen Ursprungs, Univ. München, Veterinärstrasse 13, 8000 Munich 22, Federal Republic of Germany]

132 pigs from a large experimental station and from small-holdings were examined for Cd contents in meat, liver and kidneys. Results and statistical analysis, shown graphically and in tables were as follows (ppm Cd in material from the large station

and small farmers respectively): kidneys 0.01-3.07 (mean 0.90), 0.18-5.42 (1.42); liver 0.07-0.57 (0.24); 0.07-0.98 (0.34); meat not detectable-0.13 (0.04), not detectable-0.19 (0.07). The Cd contents in liver and kidneys were directly related to the wt. of the animals (live or slaughter wt.) but not to their sex. Contents in some animals were higher than the 0.5 ppm in organs and 0.08 ppm in meat as proposed in the draft regulations (Federal Republic of Germany) on max. permissible levels of As, Pb, Cd and Hg in or on foods. RM

50

[Determination of traces of heavy metals in aroma compounds.]

Palliere, M.; Gernez, G.

Annales des Falsifications et de l'Expertise Chimique 69 (747) 821-832 (1976) [10 ref. Fr] [Rhone-Poulenc Ind., Cent. Nicolas-Grillet, 13 Quai Jules-Guesde, 94400 Vitry-sur-Seine, France]

Methods are described for detn. of As, Cd, Pb and Hg in flavourings. 2 methods are proposed for each element: a sensitive accurate AAS method (limits of detection 0.010 ppm for As and Cd, 0.050 ppm for Hg and Pb) and a simple screening method (limits of detection 1 ppm for As, 2 ppm for Cd, 5 ppm for Pb; no simple method for Hg). Application to vanilla, coffee, apricot, peach, onion and strawberry essence achieved $\leq 90\%$ recovery. A modified Pien apparatus for careful wet ashing, and apparatus for producing volatile hydrides prior to AAS (e.g. AsH_3) is described with the aid of diagrams. RM

51

Determination of metals in foods. A review. [Review]

Crosby, N. T.

Analyst 102 (1213) 225-268 (1977) [346 ref. En] [Dep. of Ind., Lab. of the Gov. Chem., Cornwall House, Stamford Street, London SE1 9NQ, UK]

The whole field of metallic elements in food is reviewed from the analysts' standpoint. The general principles of analytical methods, advantages and disadvantages of alternative techniques and practical considerations important to the food analyst are discussed. Some comments on the usage, toxicity, analysis and occurrence in food of As, Cd, Pb, Hg, Se, Sn and nutrient metals are given. Results for a number of metals in total-diet samples and in fresh and canned foods are discussed, as well as control of trace metals in foods and future developments. AL

52

[Determination of heavy metals in foods by inverse polarography. II. The content of lead, cadmium and copper in edible fungi.] Die Bestimmung von Schwermetallspuren in Lebensmitteln mit Hilfe der Inverspolarographie. II. Über den Gehalt von Blei, Cadmium und Kupfer in Speisepilzen.

Collet, P.

Deutsche Lebensmittel-Rundschau 73 (3) 75-82, (1977) [9 ref. De, en, fr] [Chem. Untersuchungsamt für das Saarland, Saarbrücken, Federal Republic of Germany]

Concn. of Cu, Cd and Pb were determined by inverse polarography and AAS in samples of fresh mushrooms, canned mushrooms, and numerous other species of edible fungi, collected in the Saar region of Germany or near Lake Maggiore, Italy. Mean values and ranges for Pb, Cd and Cu respectively (with number of samples in parentheses) were (mg/kg): fresh cultivated mushrooms (23) 0.67 and 0.008-0.196, 0.014 and 0.003-0.035 and 2.88 and 0.83-6.56; canned cultivated mushrooms (19) 0.23 and 0.064-0.501, 0.017 and 0.003-0.050, and 3.33 and 0.46-8.20; and wild edible fungi (155) not given and 0.003-3.920, not given and 0.008-10.321, and not given and 0.09-82.50. *Psaliota arvensis* and *Ps. abruptibula* had an especially high Cd concn. Data are also given for the Cd concn. in individual parts of wild edible fungi, and concn. factors relating Cd, Pb, and Cu concn. of the fungi to those of the substrate on which they were growing. [See FSTA (1975) 7 11C432 for part I.]

53

Trace metal and protein concentrations in California market milks.

Bruhn, J. C.; Franke, A. A.

Journal of Food Protection 40 (3) 170-173 (1977) [17 ref. En] [Cooperative Extension, Univ. of California, Davis, California 95616, USA]

225 market milk samples were collected in 3 major milk marketing areas in California. Samples represented 4 products: regular, extra-rich, skim- and low-fat milk. Concn. of Cd, Cu, Pb, Zn and protein were measured in all samples. The concn. of Se was measured in 103 of the samples. Mean concn. in all samples examined were ($\mu\text{g/kg}$): Cd, 5.0; Cu, 41.0; Pb, 60.3; and Se, 24.4. No significant differences between market or product means were found for these 4 metals. Mean product concn. for protein (%) and Zn (mg/kg) respectively were: regular milk, 3.29 and 3.61; extra-rich milk, 3.33 and 3.70; skim-milk, 3.61 and 3.98; and low-fat milk, 3.82 and 4.18. Low-fat and skim-milks had greater concn. of protein and Zn than did regular and extra-rich milks ($P < 0.05$). AS

54

Effects of dietary feeding of organocadmium to cattle and sheep.

Wright, F. C.; Palmer, J. S.; Riner, J. C.; Haufler, M.; Miller, J. A.; McBeth, C. A.

Journal of Agricultural and Food Chemistry 25 (2) 293-297 (1977) [9 ref. En] [US Livestock Insects Lab., USDA, Kerrville, Texas 78028, USA]

Adult cattle and sheep were fed a Cd fungicide, Cadminate, in the diet at levels of 50, 100, 200, 300 and 500 ppm of Cd. The cattle study continued for 49 wk and the sheep study for 41 wk. Greatest

residues of Cd were in the kidney and liver of both cattle and sheep. It is concluded that Cd, fed as Cadminate in feed, is detrimental to both cattle and sheep. AS

55

[Heavy metal contamination of indigenous game.]

Zur Schwermetallkontamination von einheimischem Wild.

Höllerer, G.; Coduro, E.

Zeitschrift fuer Lebensmittel-Untersuchung und -Forschung 163 (4) 260-263 (1977) [4 ref. De, en] [Landesuntersuchungsamt für das Gesundheitswesen Südbayern, Lothstrasse 21, D-8000 Munich 40, Federal Republic of Germany]

Mean values for heavy metal contents of livers of 71 hares, 127 roe deer, 9 red deer and 17 wild boar in Bavaria were, respectively, (ppm): Hg (Coleman Hg analyser), 0.55, 0.02, not detectable and 0.04; Pb (AAS), 1.10, 0.43, 0.55 and 0.38; and Cd (AAS), 0.25, 0.33, 0.27 and 0.60. Data classified into 9 regions of Bavaria are also tabulated. Concn. of Pb and Cd increased with age of animal in the 4 species studied, but the concn. of Hg increased only in hares; it remained constant in roe deer, was not detectable in red deer, and decreased in wild boar. SKK

56

[Food legislation aspects of migration and corrosion, in relation to metal packs.]

Lebensmittelrechtliche Aspekte von Migration und Korrosion im Hinblick auf Metallverpackungen.

Nehring, P.

Verpackungs-Rundschau 27 (11) 1368, 1370, 1372, 1374, 1376; (12) 1496-1498 (1976) [35 ref. De, en, fr] [Inst. für Konserventechnik, Braunschweig, Federal Republic of Germany]

Interaction of foods with metal packs is discussed, together with effects of organic lacquers or coatings. Migration of Cd, Pb and Sn are discussed in detail, with reference to the danger of contamination of the food, and possible effects on nutritional value. The use of food simulants in studies on uptake of metals is discussed, and problems of studies on corrosion of metal packs are considered. Mechanisms of corrosion of Sn and Pb by various foods are discussed. Studies showed that uptake of Al or Cr by foods is negligible. It is suggested that tolerances may be set for metals in foods; these tolerances provide adequate consumer protection. IN

57

[The Central Environmental Chemical Recording and Evaluation Office of the Federal Health Agency. III. The estimability of heavy metal intake (lead, cadmium, mercury) from foods.] Die Zentrale Erfassungs- und Bewertungsstelle für

Umweltchemikalien des Bundesgesundheitsamtes (ZEBS). III. Eine Betrachtung über die Abschätzbarkeit der Schwermetallzufuhr (Blei, Cadmium, Quecksilber) über Lebensmittel. Wosing-Narr, U.; Musche, R.

Bundesgesundheitsblatt 20 (4) 49-52 (1977) [11 ref. De, en] [Zentrale Erfassungs- & Bewertungsstelle für Umweltchemikalien, Bundesgesundheitsamt, Postfach, 1000 Berlin (West) 33]

The present state of knowledge on the intake of heavy metals through food as marketed is presented in the form of a preliminary statistical evaluation; figures are given for estimated weekly per capita intake of Pb, Cd and Hg from various food product groups, both in mg and as % of total intake. Total Pb intake is 3.09 mg/wk, with 28% from fruit, 20% from alcoholic drinks and 15% from vegetables; total Cd intake is 0.41 mg/wk, with 20% from alcoholic drinks; and total Hg intake is 0.18 mg/wk, with 22% from alcoholic drinks and 18% from fish and fish products. JRR

53

[Trace metal determination in drinking water by flame-AAS after concentration by means of activated carbon.] Spurenmetallbestimmung im Trinkwasser mit der Flammen-AAS nach Anreicherung über Aktivkohle. Mihm, U.; Leberl, C.

Zentralblatt fuer Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, IB 164 (3) 262-270 (1977) [5 ref. De, en] [Hygiene-Inst., Univ. Bonn, Klinikgelände 35, D-5300 Bonn-Venusberg, Federal Republic of Germany]

A procedure for detn. of low concn. of Pb, Cd, Cr and Zn in drinking water is described. 1 l. of the water under test is adjusted to pH 3.5 with 2N HCl, and mixed with 50 ml of a 1% aqueous solution of the complexing agent ammonium pyrrolidine dithiocarbamate. After approx. 1 min the mixture is filtered using a nitrocellulose membrane filter covered with 50 mg activated C powder. The filter + activated C is heated with 3 ml concn. HNO₃; the vol. is then made up to 10 ml. This procedure thereby gives a 100-fold concn. of the heavy metals present in the water. A 200 µl sample is then analysed by flame AAS; heavy metal concn. are determined by reference to calibration curves. Recovery is 80-100%. Accurary and reproducibility of the method comply with the requirements of the current German standards for analysis of drinking water. AJDW

54

[Heavy metal accumulation in mushrooms.] Schwermetallanreicherungen in Pilzen.

Enke, M.; Matschiner, H.; Achtzehn, M. K. *Nahrung* 21 (4) 331-334 (1977) [17 ref. De, en, ru] [Hygiene-Inst. des Bezirkes Halle, German Democratic Republic]

Concn. of Cu, Pb, Cd and Zn were determined by square-wave polarography in samples of the fungi (including *Hypholonia fasciculare*, *Polyporus frondosus*, *Armillaria mellea*, *Macrolepiota procera*, and *Pholiota squarrosa*) collected either (i) ≤ 800 m or (ii) 800-5000 m from a non-ferrous metal smelting plant. Ranges of values for heavy metal concn. were for (i) samples (µg/g DM): Cu, 130-185; Pb, 51-178; Cd, 4.5-36; and Zn, 120-1170. Corresponding values for (ii) samples were: Cu, 33.1-85.5; Pb, 1.3-10.0; Cd, 2.2-2.5; and Zn, 9.5-51.4. IN

55

Hormones, drugs, metals and pesticides in milk: a guide to the literature. [Review]

Cowie, A. T.; Swinburne, J. K.

Dairy Science Abstracts 39 (7) 391-402 (1977) [many ref. En] [Nat. Inst. of Res. in Dairying, Shinfield, Reading RG2 9AT, UK]

Mechanisms of excretion are reviewed generally and the transfer of specific substances into milk are considered, covering particularly human and cows' milk. JMD

56

Trace metals (As, Cd, Cu, Fe, and Zn) in Arctic cod, *Boreogadus saida*, and selected zooplankton from Strathcona Sound, Northern Baffin Island. Bohn, A.; McElroy, R. O.

Journal of the Fisheries Research Board of Canada 33 (12) 2836-2840 (1976) [5 ref. En, fr] [Div. of Applied Biol., BC Res., Vancouver, British Columbia V6S 2L2, Canada]

Arctic cod (*Boreogadus saida*) were captured by bottom trawl at depths of 120-300 m. Zooplankton were obtained by bottom to surface tows from the Arctic cod habitat. Average concn. of As and Zn were higher in Arctic cod fillets than in livers from the same fish; Cd and Fe concn. were higher in livers. The difference between Cu concn. in muscle and liver was not significant. As and Zn in whole fish, and As in fillets from 7 specimens, were positively correlated to body wt. Cu and Fe in whole fish were negatively correlated to body wt., whereas Cd was not related to body wt. Examination of Arctic cod stomach contents indicated that planktonic copepods were important in the diet. Cd levels were 5-8 times higher in the unsorted copepods than in the Arctic cod, whereas As, Cu, Fe, and Zn were higher in the fish than in the copepods. AS

57

[Environmental contamination with heavy metals.] Umweltkontamination durch Schwermetalle.

Bergel, C.

Deutsche Milchwirtschaft 28 (14, Beil, Lebensmittel-Labor) IV-VI, VIII-XII, XIV (1977) [7 ref. De]

This review-type article deals with Federal German legislation; contamination of foods with

Hg, Pb and Cd; and detn. of heavy metal traces, with particular reference to AAS techniques and sample preparation procedures. Comments from own experience on AAS analysis are included. SKK

58

[Polarographic determination of heavy metals in wine.]

Popko, R.; Pietrov, S. J. [Petrov, S. I.] *Przemysł Spożywczy* 31 (4) 150-151 (1977) [5 ref. Pl, ru, en, fr, de] [Moskovskii Tekh. Inst. Pishchevoi Promyshlennosti, Moscow, USSR]

Using a PPT-1 polarograph, heavy metal contents were determined in 6 samples each of port 13, and port 33 from the USSR market and of Amfora wine and 'Podczaszy' mead 'trojniak' quality) from the Polish market. The samples were dry-ashed. Mean values with SEM were, in the order of wines listed (mg/l.): Cu, 1.4 ± 0.07 , 3.7 ± 0.14 , 3.7 ± 0.05 and 2.4 ± 0.04 ; Pb, 0.10 ± 0.002 , 0.25 ± 0.006 , 0.20 ± 0.004 and 0.19 ± 0.005 ; Cd, 0.01 ± 0.0003 , 0.02 ± 0.0004 , 0.01 ± 0.0004 and 0; Zn, 0.60 ± 0.02 , 1.15 ± 0.01 , 0.78 ± 0.01 and 0.35 ± 0.07 ; Mn, 1.0 ± 0.002 , 0.64 ± 0.01 , 0.62 ± 0.02 and 0.10 ± 0.004 ; and Fe, 5.2 ± 0.03 , 2.1 ± 0.02 , 3.0 ± 0.02 and 1.4 ± 0.02 . The sensitivity of the method was 0.01 mg/l. SKK

59

Plant quality response to uptake of polluting elements. [Lecture]

Cottenie, A.; Dhaese, A.; Camerlynck, R. *Qualitas Plantarum - Plant Foods for Human Nutrition* 26 (1/3) 293-319 (1976) [29 ref. En, de] [State Univ., Ghent, Belgium]

This paper includes data for concn. of heavy metals (Pb, Zn, Cu, Cd, Cr) in various vegetables from the vicinity of a metal-processing plant and from a non-polluted zone, and for effects of washing on the concn. of heavy metals on or in vegetables. Washing commonly significantly reduced heavy metal concn. The significance of vegetables as a source of toxic heavy metals in the diet is discussed, it is concluded that hazardous heavy metal concn. are likely to occur only in plants grown in highly-polluted soil and exposed to surface contamination. [See FSTA (1977) 9 10T1369.] AJDW

60

[Heavy metals in the substrate and in mushrooms (*Agaricus bisporus*) fertilized with municipal waste compost.] Schwermetallgehalte im Kultursubstrat und Erntegut des Champignons. *Agaricus bisporus* (Lange) Singer, beim Einsatz von Müllklarschlammkompost. Domsch, K. H.; Grabbe, K.; Fleckenstein, J. *Zeitschrift für Pflanzenernährung und Bodenkunde* No. 4, 487-501 (1976) [44 ref. De, en] [Inst. für Bodenbiologie, Forschungsanstalt für Landwirtschaft, Braunschweig, Federal Republic of

Germany]

Effects of incorporation of $\leq 75\%$ municipal waste compost (MWC) in a horse-dung based mushroom compost on the heavy metal content of mushrooms grown therein were studied. Heavy metal concn. in mushrooms grown in normal mushroom compost and in the mixture containing 75% MWC were, respectively (mg/kg fresh wt.): Zn, 7.80 and 9.93; Cu, 5.6 and 11.1; Pb, 0.70 and 0.92; Cd, 0.13 and 0.42; Hg, 0.13 and 0.53; and As, 0.16 and 0.16. The heavy metal contents of samples grown in the compost containing 75% MWC had Zn, Cu, Cd, As and Pb concn. within the normal range for vegetables; Hg concn. were, however, higher than those in most vegetables. AJDW

61

A spectrographic method for the determination of some heavy metals and boron in plant ash.

Parle, P. J.; Fleming, G. A.

Irish Journal of Agricultural Research 16 (1) 49-55 (1977) [14 ref. En] [An Foras Taluntais, Johnstown Castle Res. Cent., Wexford, Irish Republic]

A spectrographic method based on that of Tennant [Applied Spectroscopy (1967) 21, 282] for detn. of B and heavy metals in plants is described. Fresh plant material is dried, ground, ashed, and mixed (1:1) with a spectroscopic buffer mixture comprising 7 parts Al_2O_3 , 3 parts $CaCO_3$, and 1 part K_2CO_3 . It is then arced in graphite electrodes, and analysed by spectrography, using an In internal standard. Detection limits were (ppm in the ash): Ag 0.1; B 1.0; Bi < 1.0; Cu 3.0 or 30.0, depending on the analytical line used; Ga 1.0; Pb 1.0 or 30.0, depending on the analytical line used; Sb 20; Sn 1.0; Zn 30, Ge < 1.0; Ti 1.0; and Cd 1.0. Data are given for heavy metal concn. determined in turnips, lettuce and standard kale samples by this method. Precision was better than 10% for most samples. AJDW

62

Heavy metals in soils, herbage and vegetables from an industrialised area west of Dublin city.

Fleming, G. A.; Parle, P. J.

Irish Journal of Agricultural Research 16 (1) 35-48 (1977) [24 ref. En] [An Foras Taluntais, Johnstown Castle Res. Cent., Wexford, Irish Republic]

Studies on concn. of Pb, Sn, Zn, Cu, Cd and Sb in soils, herbage, field crops and garden crops in a 150 km² area on the western perimeter of Dublin are described. Tables of data are given, including values for heavy metal concn. in or on cabbage, kale, swede tops, leeks, lettuces, onions, rhubarb, spinach, potatoes, beetroot, parsley, thyme, gooseberries, strawberries, raspberries, and apples. A pot study was conducted to study uptake of heavy metals from soils by various food plants. Lettuce had the highest Cd uptake value of the vegetables studied. On the basis of comparison of the results with WHO tolerable weekly intake values for heavy metals, it is suggested that Cd presents a greater health hazard than Pb. AJDW

63

[Determination of cadmium in the presence of mercury in fish.]

Gajewska, R.

Bromatologia i Chemia Toksykologiczna 10 (1) 35-38 (1977) [6 ref. Pl, en, ru] [Zakład Bromatologii Inst. Chem. i Anal. Wydziału Farmaceutycznego, Akad. Med., 80-416 Gdansk, Poland]

The procedure involves wet mineralization of the sample followed by selective detn. with dithizone of both Cd and Hg ions after adjustment of the pH of the test solution, and using masking agents to prevent interference by other elements. The method was verified by 2 recovery tests: addition of a specific quantity of Cd to the fish sample before mineralization; and introduction of Cd to the mineralized sample after prior detn. of the Hg content. The mean recovery was 98 and 99% for the 2 methods, respectively. AS

64

[Concentration of Hg, Cd, Pb and Cu in the surrounding seawater and in seaweeds, *Undaria pinnatifida* and *Sargassum fulvellum*, from Suyeong Bay in Pusan.]

Kim, C. Y.; Won, J. H.

Bulletin of the Korean Fisheries Society 7 (3) 169-178 (1974) [38 ref. Ko, en] [Pusan Fisheries Coll., Pusan, Korea]

Concn. of Hg, Cd, Pb and Cu were determined in the surrounding seawater and in seaweeds, (i) *Undaria pinnatifida* and (ii) *Sargassum fulvellum*, from Suyeong Bay during the spring and neap tides in 1974. The mean and range of heavy metal concn. in the surrounding seawater were (parts/billion): Hg, 0.16 (0.00-0.39); Cd, 0.18 (0.00-0.46); Pb, 0.26 (0.00-0.94); and Cu, 0.25 (0.00-0.86). These concn. varied slightly according to the tide. The mean and range of heavy metal concn. (ppm, air dry basis) were for (i) and (ii) respectively: Hg, 0.07 (0.02-0.48) and 0.04 (0.01-0.09); Cd, 0.37 (0.14-3.2) and 0.18 (0.11-0.31); Pb, 2.3 (0.8-5.0) and 1.4 (0.8-2.2); and Cu, 3.7 (1.4-6.9) and 5.7 (3.6-13.1). The concn. rate of Hg, Cd and Pb in (i) was almost twice that in (ii) but concn. rate of Cu was slightly smaller. AL

65

[Cadmium contents in tissues and organs of bull calves after a single administration of cadmium chloride by mouth.]

Zmudzki, J.

Medycyna Weterynaryjna 33 (1) 41-42 (1977) [9 ref. Pl, ru, en] [Zakład Farmakologii i Toksykologii, Inst. Weterynarii, Puławy, Poland]

17 Polish Black-and-White Lowland bull calves aged 6-8 months were divided into 3 groups: (i) 3 served as control, (ii) 7 received by mouth a single dose of 5 mg Cd/kg body wt. as CdCl₂, and (iii) 7 received similarly 20 mg Cd/kg body wt. 2 animals

each from (ii) and (iii) groups were slaughtered after 6 and 13 days respectively; and the remainder, and the (i) animals were slaughtered after 25 days. Mean Cd contents determined by AAS were for all

animals in (i)-(iii) respectively (mg/kg): blood 0.022, 0.032 and 0.053; muscle, 0.034, 0.045 and 0.075; heart, 0.042, 0.060 and 0.171; testicles, 0.045, 0.501 and 1.351; brain, 0.048, 0.275 and 0.763; liver, 0.171, 3.994 and 13.691; and kidneys, 0.677, 5.048 and 13.452. SKK

66

Health laws and regulations - United Kingdom. World Health Organization

International Digest of Health Legislation 28 (1) 158-189 (1977) [En] [Geneva, Switzerland]

A selection of UK health laws and regulations is presented including the following which relate to food hygiene: The Specified Sugar Products Regulations 1976. S.I. 1976/509 (dated 26 March, 1976) have been made to implement Council Directive No. 73/437/EEC of 11 Dec., 1973; The Vitreous Enamel-ware (Safety) Regulations 1976. S.I. 1976/454 (dated 22 March, 1976) impose requirements relating to the permissible level of release of Pb and Cd from vitreous enamel articles for use with food; The Labelling of Food (Amendment) Regulations 1976. S.I. 1976/859 (dated 1 June, 1976) amend Regulation 25 (which deals with diabetic claims) of the Labelling of Food Regulations 1970; The Poultry Meat (Hygiene) Regulations 1976. S.I. 1976/1209 (dated 29 July, 1976) implement Council Directive No. 71/118/EEC of 18 Feb., 1971, on health problems affecting trade in fresh poultry meat, as amended by Council Directive No. 74/387/EEC of 15 July, 1974, and Council Directive No. 75/431/EEC of 10 July, 1975; An Act (Chapter 58) to enable the UK to accede to the Agreement on the International Carriage of Perishable Foodstuffs and on the Special Equipment to be used for such Carriage (ATP) and for purposes connected therewith (dated 15 Nov., 1976); and The Colouring Matter in Food (Amendment) Regulations 1976, [Continued in following abstr.] VJG

67

Determination of heavy metals in food. [Lecture] Crosby, N. T.

IFST Proceedings 10 (2) 65-70 (1977) [9 ref. En] [Lab. of the Gov. Chem., Cornwall House, Stamford Street, London SE1 9NQ, UK]

The principal stages in the analysis of a food for its trace metal content are discussed. The importance of obtaining a representative sample for analysis is stressed, with particular reference to the different distributions of trace metals in tea leaves and tea dust, and between the solid and liquid contents of canned vegetables. Tables of results are included with these examples. The destruction of organic matter is the next stage in analysis, and this is followed by separation and concn. of the

elements of interest. AAS, flame emission and colorimetric methods are discussed as end-detn. methods. The reproducibility of the techniques is mentioned, and values for Hg and Cd contents of some selected foods are given. DIH

68

[Accuracy of description of foods of plant origin.] Deklaration und Wirklichkeit bei pflanzlichen Erzeugnissen. [Lecture] Tangemann, R.

Qualitas Plantarum - Plant Foods for Human Nutrition 27 (1) 55-58 (1977) [2 ref. De, en] [Arbeitsgemeinschaft der Verbraucher, Heilshachstrasse 20, 53 Bonn-Duisdorf, Federal Republic of Germany]

The lack of regulations limiting heavy metal concn. in foods in the Federal Republic of Germany is critically discussed. Labelling of foods with terms suggesting purity, naturalness or freedom from contamination is also criticized; even crops grown without the use of pesticides will probably contain various environmental pollutants, e.g. heavy metals. It is suggested that future legislation should restrict these terms to foods free from all contaminants. [See FSTA (1977) 9 11A722.] AJDW

69

[Effect of increasing concentrations of Pb, Cd, Cr, Ni, or Zn on kohlrabi (*Brassica oleracea* L. var. gongylodes LAM) grown in nutrient solution.] Die Wirkung steigender Gaben von Blei, Cadmium, Chrom, Nickel oder Zink auf Kohlrabi (*Brassica oleracea* L. var. gongylodes LAM) in Nährlösung. Foroughi, M.; Hoffman, G.; Teicher, K.; Venter, F. *Gartenbauwissenschaft* 41 (6) 241-247 (1976) [27 ref. De, en, fr, ru] [Lehrstuhl für Gemüsebau, Tech. Univ. München, Weihenstephan, Federal Republic of Germany]

Investigations were carried out into the effect of increasing concn. (up to 250 ppm) of 5 heavy metals (Cd, Cr, Ni, Pb and Zn) in the nutrient solutions applied to 2 var. of kohlrabi, on their distribution in leaves, roots and tubers. Non-specific poisoning symptoms were observed for Cd from 1.5 ppm and for Ni from 2 ppm in the solution, these metals being more toxic than the remainder, although tuber yield was decreased by relatively low concn. in all cases. The metal content of the DM of leaves and tubers was positively correlated with solution concn. up to 20 ppm in all cases with the exception of Cr in the tubers, which reached a max. of 25 ppm at 1 ppm solution concn. and declined thereafter. Cd content in the solids of both leaves and tubers reached remarkably high levels of 480 ppm in leaves and 280 ppm in tubers at only 3 ppm solution concn. Levels of Zn also increased rapidly, in about equal amounts for leaves and tubers, reaching 350 ppm at 2 ppm in the solution and exceeding 1000 ppm at 20 ppm. Pb appeared to be preferentially concentrated in the tubers and reached 90 ppm in the DM at a solution concn. of 20 ppm. BDH

70

Micro-determination of lead and cadmium in pasteurized market milks by flameless atomic absorption spectroscopy using a base digest.

Barlow, P. J.

Journal of Dairy Research 44 (2) 377-381 (1977) [8 ref. En] [Dep. of Construction & Environmental Health, Univ. of Aston in Birmingham, Birmingham, UK]

Using a modified method of Barlow & Khera [Atomic Absorption Newsletter (1975) 14, 149], 10 commercial milk samples from Birmingham were prepared for flameless AAS using Soluene 350 (Packard Instrument Co. Inc., Reading, Berks, UK), which is a quaternary ammonium hydroxide (0.5 ml pasteurized milk and 2 ml Soluene 350 made to 10 ml with Analar grade toluene); no heating was necessary. The Pb contents were all < 5 µg/l. and mean Cd was 1.10 µg/l. Recovery of added Pb and Cd was 100 and 112% respectively. Detection limits were 5 and 0.25 µg/l. respectively using 25 µl samples. Over 3 months, 100 further samples of cartoned or bottled milk retailed by 2 large dairies in the Birmingham area have been examined. The method is rapid and reproducible. DMK

71

Evaluation of carcinogenic risk of chemicals to man. Cadmium, nickel, some epoxides, miscellaneous industrial chemicals and general considerations on volatile anaesthetics. World Health Organization; International Agency for Research on Cancer

IARC Monographs 11, 306pp. (1976) [many ref. En] 1211 Geneva 27, Switzerland Price FS34.00

This publication represents the views of 2 IARC Working Groups on the Evaluation of the Carcinogenic Risk of Chemicals to Man which met in Lyon on 9-11 Dec. 1975 and 3-9 Feb. 1976. The monographs give chemical and physical data, production, use, occurrence and analysis, biological data relevant to the evaluation, comments on data reported and evaluation, and references, for the following chemicals: Cd and Cd compounds; Ni and Ni compounds; epoxides, including diepoxybutane, epichlorohydrin, cis-9,10-epoxystearic acid, ethylene oxide, fusarenon-X, glycidaldehyde, and propylene oxide; and miscellaneous industrial chemicals, including γ-butyrolactone, ethylene sulphide, and trichloroethylene. AL

72

[Effects of addition of cadmium to broiler and laying hen feed on the performance of the birds and the residue levels in the tissues and eggs. II. Effects of various amounts of added cadmium on residues in the tissues and eggs.] Der Einfluss von Cadmiumzusätzen zum Broiler- und Legehennenfutter auf die Leistung der Tiere und auf Rückstandsgehalte in den Geweben und Eiern. II. Einfluss verschiedener Cadmiumzusätze zum

Futter auf die Rückstände in den Geweben und den Eiern.

Nezel, K.; Vogt, H.

Archiv für Geflügelkunde 41 (3) 81-86 (1977) [21 ref. De, en, fr, ru] [Inst. für Kleintierzucht, Forschungsanstalt für Landwirtschaft, Dörnbergstrasse 25-27, 3100 Celle, Federal Republic of Germany]

Studies were conducted on effects of diets containing 0, 1, 2, 5, 10, 20, 40 or 80 ppm Cd (fed for 7 wk) on the Cd concn. in tissues (breast and thigh muscle, bones, liver, kidneys) of broilers, and of diets containing 0, 5 or 10 ppm (fed for 47 wk) on Cd concn. in the tissues and eggs of laying hens. Tables and graphs of results are given. In general, Cd concn. in tissues and egg yolk increased with increasing dietary Cd concn. and increasing time of exposure to the Cd-containing diet. Of the tissues studied, kidneys had the highest Cd concn., followed, in order of decreasing Cd concn., by liver, bone, thigh muscle and breast muscle. Regression equations relating tissue Cd concn. to dietary Cd concn. are given. Cd supplementation of the diet had no significant effect on Cd concn. in egg white. [See *Archiv für Geflügelkunde* (1977) 4 (1) 1-9 for part I.] AJDW

73

[Cadmium uptake by mushrooms.] Über die Cadmiumanreicherung in Champignons.

Laub, E.; Waligorski, F.; Woller, R.; Lichtenthal, H.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 164 (4) 269-271 (1977) [19 ref. De, en] [Chem. Untersuchungsamt Trier, Maximineracht 11a, D-5500 Trier, Federal Republic of Germany]

68 samples of non-poisonous wild mushrooms of the genus *Agaricus* were gathered from various locations around Trier. 32 samples were of the sub-genus *Rubescens* and had an average Cd content of 0.22 ppm (wet wt.), 2.5 ppm (dry wt.). 36 samples were of the sub-genus *Flavescentes* and had an average Cd content of 3.70 ppm (wet wt.), 33.8 ppm (dry wt.). These differences were not found to reflect differences in locations - 4 locations which grew samples of both subgenera were examined and 10-50× more Cd was found in *Flavescentes* than in *Rubescens*. Experiments were performed with cultured mushrooms (*Rubescens*) on substrates containing added Cd in amounts of 0, 1 ppm (representing normal to high Cd content) and 10 ppm (representing extremely high Cd content). Cd contents of mushrooms for 0, 1 and 10 ppm substrates were 0.05, 0.17 and 1.00 ppm (wet wt.) respectively, and 0.36, 1.24 and 7.05 ppm (dry wt.) respectively. Mushroom caps contained twice the Cd contents of stems. It is concluded that consumption of wild mushrooms of sub-genus *Rubescens* (including *Agaricus campestris* which is frequently gathered) presents no danger to health. DIH

74

[Quantitative distribution of heavy metals in rice and their removal.]

Minagawa, K.; Takizawa, Y.

Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 18 (1) 13-19 (1977) [9 ref. Ja, en] [Dep. Public Health, School of Med., Akita Univ., Hondo 1-chome, Akita-shi, Japan]

The quantitative distribution of heavy metals in brown rice polluted with Cd and the removal of these elements were studied. It was found that the distribution of Cd, Cu and Zn in the grains was even. >90% of the Cd and Zn in crushed brown rice was removed by treatment with a tartaric acid solution. TN

75

[Heavy metals of mill byproducts.] Schwermetalle in Mühlennachprodukten.

Ocker, H. D.

Getreide, Mehl und Brot 31 (4) 97-100 (1977) [5 ref. De] [Bundesforschungsanstalt für Getreide- & Kartoffelverarbeitung, Detmold, Federal Republic of Germany]

The heavy metal contents of mill by-products were studied; this paper covers Pb and Cd, and further elements will be dealt with in later papers. The products analysed (approx. 100 samples in all) were wheat: grain, flour, secondary flour, fodder flour, semolina bran, bran germ; and rye: grain, flour, secondary flour, semolina bran and bran. Results are tabulated. The raw materials had low Pb and Cd contents (highest values 0.11 ppm Pb and 0.13 ppm Cd), whereas some of the by-products e.g. wheat secondary flour and bran had values \leq 0.47 ppm Pb and 0.37 ppm Cd. In wheat, the Pb content increased with the ash content of the by-product; the flours had lower Pb contents than the starting grain; the Cd contents of the by-products were unrelated to ash content; and the flours had a lower Cd content than the starting grain. In rye, the concn. of Pb and Cd were not related to the ash content of the by-products; and the heavy metal content of flour was as high as in the starting grain. Rye starting grain and by-products had lower Cd contents than the wheat and wheat products; also, on average, Pb contents of rye products were lower than those of the wheat. The absolute values for all the samples for both heavy metals were low, and the Pb content was well below the legal limit of 5 ppm for fodder material. IVR

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FAB 37

CADMIUM IN FOODS

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H. BROOKES

ASSISTANT EDITOR

1

Dry ash-voltammetric determination of cadmium, copper, lead, and zinc in foods.

Jones, J. W.; Gajan, R. J.; Boyer, K. W.; Fiorino, J. A.

Journal of the Association of Official Analytical Chemists 60 (4) 826-832 (1977) [17 ref. En]
[Div. of Chem. & Physics, FDA, Washington, DC 20204, USA]

An analytical method is presented for determining Cd, Cu, and Pb by differential pulse anodic stripping voltammetry and Zn by cathodic scan differential pulse voltammetry. Food samples are dry ashed using a sulphuric acid ashing aid, dissolved in dilute nitric acid, buffered at pH 4.3 with an acetate buffer, and quantitatively analysed using the technique of standard additions at a hanging mercury drop electrode. The quantitation limits ($5 \times$ estimated detection limits) are approx. 5 ng/g for Cd, Cu and Pb, and 50 ng/g for Zn. Accuracy of the method was established by analysis of National Bureau of Standards Standard Reference Material No. 1577 Bovine Liver, comparison of results obtained by independent analytical methods, and quantitative recovery of analyte metals from fortified, non-canned food samples (including vegetables, meat, flour, sugar, cheese and milk). Results from an inter-laboratory method trial indicate that the method is suitable for the analysis of a variety of food types. AS

2

Trace elements in wastewater.

Chang, A. C.; Page, A. L.

California Agriculture 31 (5) 32-33 (1977) [En]
[Dep. of Soil & Environmental Sci., Univ. of California, Riverside, California, USA]

This paper includes data for heavy metal concn. in lettuce plants grown on soils treated with sewage sludge at levels of (i) 0, (ii) 11.25, (iii) 22.50 or (iv) 45.0 l/ha. Mean values for Zn, Cu and Cd in the lettuces were respectively ($\mu\text{g/g}$): (i) 58.8, 6.2 and 1.9; (ii) 90.7, 8.0 and 2.1; (iii) 141.3, 6.0 and 4.0; and (iv) 151.6, 6.1 and 4.1. Barley grown under the same conditions showed no significant increase in heavy metal concn. with increasing level of sludge application. The results are discussed in relation to possible accumulation of toxic concn. of heavy metals in food crops grown on sewage sludge-treated soil. AJDW

3

[Heavy metals in foods.]

Ellen, G.

Voeding 38 (9) 443-460 (1977) [53 ref. Nl, en]
[Keuringsdienst van Waren, Leeuwarden, Netherlands]

Data (presented as tables and block diagrams) are given for concn. of Cd, Hg and Pb in numerous samples of various foods consumed in the Netherlands, including potatoes, rye and wheat flours, bread, milk and dairy products, fresh

vegetables, pulses, rice and rice products, apples, pears and bottled and canned baby foods. Ranges of values for heavy metal concn. in the products studied were ($\mu\text{g/kg}$): Cd <0.5-33; Pb 5-130; and Hg <1-65. These results are compared with literature data. Average daily intakes of heavy metals from foods are calculated, and compared with FAO/WHO recommendations. Problems of Quantitative detn. of heavy elements in foods are briefly discussed. AJDW

4

[Atomic absorption spectrophotometry for determining cadmium in fruit and vegetable products.]

Brzozowska, B.

Roczniki Panstwowego Zakladu Higieny 28 (2) 195-200 (1977) [12 ref. Pl, ru, en] [Zaklad Badania Zywnosci i Przedmiotow Uzytku Panstwowego Zakladu Higieny, Warsaw, Poland]

AAS with the standard addition technique was used for detn. of Cd in the following canned products: green peas, sliced beans, sorrel, blackcurrant compotes, greengage compotes, and orange juice. The products were dry ashed. Each ash was divided into 3 portions, known amounts of Cd were added to 2 portions, and all portions were supplemented to a defined vol. Detn. were performed using a Pye Unicam SP 90 A spectrophotometer, and they served as a base for plotting a curve for absorbance against concn. of added metal. The curve was extrapolated to zero absorbance for reading directly the content of the metal in the product. The contents found were in the range 10-80 $\mu\text{g/kg}$ with a coeff. of variation of 5-15%, and 80-130% recovery. AS

5

Flue dusts as zinc fertilizers.

Brown, A. L.; Burau, R. G.; Giger, D. R.

California Agriculture 31 (8) 16-17 (1977) [En]
[Dep. of Land, Air, & Water Resources, Univ. of California, Davis, California, USA]

The application of the following: reagent-grade $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ (22.7% Zn); reagent grade ZnS (67% Zn); mine ore (FST); granular sulphate flue dust (LC1) and granular precipitator dust from a fertilizer plant (PD) to sweet corn var. Golden Cross Bantam T51, was studied. All Zn sources were applied at rates of 0, 1, 4, 16 and 64 p.p.m. Zn. Results for dry wt. of sweet corn as % of yield with ZnSO_4 show similar yields for all sources except ZnS; however, Zn concn. in sweet corn was highest for FST (19 p.p.m.) and lowest for ZnS (2 p.p.m.). The effect of soil incorporation of Cd contained in Zn sources on uptake of Cd by sweet corn showed a linear relationship between Cd concn. in sweet corn and Cd applied to soil. With romaine lettuce there was an initial rapid increase of Cd concn. with increasing concn. of Cd applied; however, at higher levels of Cd applied (> approx. 2.8 p.p.m.), there was only a gradual increase in Cd in the lettuce. An analysis of FST, LC1 and PD is given in table form. It is concluded that before

these materials are used as fertilizers, they should be analysed so that hazardous constituents may be identified. SP

6

[Determination of heavy metal traces in oils, fats and animal feeds.] Bestimmung von Schwermetallen in Ölen, Fetten und Futtermitteln. Sagredos, A. N.

Fette, Seifen, Anstrichmittel 79 (8) 331-334 (1977) [24 ref. De, en] [Fak. für Chemieingenieurwesen, Univ., Thessaloniki, Greece]

In view of W. German and EEC max. tolerances for As, Pb, Cd and Hg in fats, oils, margarine and animal feeds, methods for detn. of trace amounts were investigated. AAS was found to be the best method for detn. of Pb, Cd and Hg, and colorimetry for As. Digestion methods for each substrate are described, and recoveries and detection limits tabulated as follows: edible fats-Pb 89-100% recovery (10 µg), detection limit 0.05 ppm; Cd 83-100% (2 µg), 0.05 ppm; As 87-100% (2 µg), 0.01 ppm; Hg 93-100% (0.05 µg), 0.01 ppm; reproducibility (5 replicates) for margarine and culinary oil respectively -As 4.30 and 5.99% SD of the mean, Pb 4.94 and 1.11%, Cd 6.60 and 8.90%, and Hg 3.46 and 2.55%. [See also FSTA (1977) 9 IN2.] RM

7

[Mercury, cadmium and lead contents of sea and freshwater fish.]

Gajewska, R.; Nabrzyski, M.

Roczniki Państwowego Zakładu Higieny 28 (2) 215-224 (1977) [13 ref. Pl, ru, en] [Zakład Bromatologii Inst. Chemii i Analitiki Akad. Med. Gdansk, Poland]

The results of investigations of 646 samples of a large number of fish spp. for presence of Hg, 357 samples for presence of Cd and 492 for presence of Pb are reported. The metals were determined spectrophotometrically by the dithizone method. The fishes investigated were from the Baltic Sea, the lower Vistula and Nogat, and from various lakes in the Kaszuby Lake district. The average heavy metal levels (µg/100 g) calculated for all fishes were Hg 6.5, Cd 4.1 and Pb 19.9. The highest Hg levels were found in Vimba vimba and bream, 46.4 and 39.6 µg/100 g, respectively, caught in the Vistula river near its estuary. The Cd level was highest (15.0 µg/100 g) in soles caught in the Baltic Sea near the Vistula estuary, and the maximal Pb level (264 µg/100 g) was in European white-fish from Betyn Lake. The molar relationship of Hg to Cd and Pb was 1:1:3. AS

8

[Cadmium content of salt-water and fresh-water fish.]

Gajewska, R.

Bromatologia i Chemia Toksykologiczna 10 (2) 137-140 (1977) [8 ref. Pl, en, ru] [Zakład

Bromatologii Inst. Chemii i Anal. Wydziału Farmaceutycznego Akad. Med., Gdansk, Poland]

During 1973-1975, 107 samples of salt-water fish (cod, herring, flounder, sprat) and 114 of fresh-water fish (pike-perch, pike, bream, perch, tench, roach, salmon, carp, white bream, peluga, whitefish, bleak) were analysed for contents of Cd after wet ashing. Conc. (µg/100 g tissue) ranged from 1.0 to 15.0 for the salt-water fish and from <1.0 to 14.4 for the fresh-water fish. These levels are considered to be within the weekly intake levels recommended by FAO/WHO. HBr

9

[Results of food control in Switzerland in 1976.]

Die Durchführung der Lebensmittelkontrolle in der Schweiz im Jahre 1976.

Matthey, E. (Switzerland, Eidgenössisches Gesundheitsamt, Abteilung Lebensmittelkontrolle) *Mitteilungen aus dem Gebiete der Lebensmitteluntersuchung und Hygiene* 68 (3) 279-397 (1977) [De, Fr]

727176 000 samples of 56 types of food and food ingredient as well as 330 samples of 7 types of food additives were analysed in 1976 by the Swiss Public Health authorities. Extracts from the annual reports of the 20 cantonal laboratories give detailed tables of results for each class of product. Stress is given to analysis of food additives (e.g. flavourings, antioxidants and emulsifiers) and of toxic heavy metals. [See FSTA (1977) 9 3A222 for 1975 report.] DIH

10

[Determination of cadmium in foods.]

Parolari, G.; Pezzani, G.

Industria Conserve 52 (2) 130-132 (1977) [19 ref. It, en, de, fr] [Sta. Sperimentale per l'Ind. delle Conserve Alimentari, Parma, Italy]

The proposed method involves destruction of the sample either by acid digestion or by ashing at 350°C, extraction of Cd as dithizonate and detn. of the metal by flameless AAS at 229 nm. The specificity of the extraction and the sensitivity of the AAS method allow detn. of traces of Cd with good reproducibility in samples rich in interfering ions, e.g. preserved foods. Tabulated results of analyses show Cd contents (parts/billion (p.p.b.)) of 13 and 14 in fresh pork, 28 and 29 in cooked ham, 24 in Mortadella, 18 in canned meat (with 95-108% recovery from 40 p.p.b., 90-120% from 10 p.p.b. added Cd), 72 in canned tuna and 475 in fresh kidney (suggesting in vivo renal accumulation). The concn. in triple tomato concentrate (6 replicates) varied from 9.6 to 11.9 p.p.b., with 8.49% error. RM

11

[Investigation of a method for determining lead, cadmium, mercury, arsenic and tellurium in food by X-ray fluorescence.] Untersuchung einer Methode zur Bestimmung von Blei, Cadmium, Quecksilber, Arsen und Tellur in Lebensmitteln mit Hilfe der Röntgen-fluoreszenzanalyse. Menke, H.

Zeitschrift für Analytische Chemie 286 (1/2) 31-35 (1977) [10 ref. De, en] [Johannes Gutenberg- Univ., Inst. für Kernchemie, Postfach 3980, D-6500 Mainz, Federal Republic of Germany]

Pb, Cd, Hg, As and Te were determined in foods of animal origin after digestion with a $\text{HNO}_3\text{:H}_2\text{SO}_4$ (65:35) mixture in a polyethylene flask at 60°C, or preferably with HNO_3 in a steel vessel at 150°C, the latter method being preferred because of the small amounts of reagents required. Pb, Cd and Hg are separated by the chelating resin Chelex 100 or by precipitation with ammonium pyrrolidine dithiocarbamate, using Cu as carrier; As and Te are separated by precipitation from the filtrate with H_2S , using Cu as carrier. Quantitative detn. was performed by energy-dispersive X-ray fluorescence analysis, using ^{109}Cd or ^{241}Am sources or an X-ray tube with Zr or Mo as secondary target for the excitation. 1 µg Pb and Hg and 0.5 µg As and Te could be determined. Tabulated results showed > 90% recovery of ^{109}Cd , ^{212}Pb , ^{203}Hg , ^{127}Te and ^{76}As in tuna, beef, pork, kidney and lard following digestion with HNO_3 at 150°C. RM

12

[Release of lead and cadmium from porcelain and ceramic utensils.] Untersuchungen über die Abgabe von Blei und Cadmium aus Porzellan- und Keramikgeschirr.

Dömling, H.-J.; Kolb, C.

Deutsche Lebensmittel-Rundschau 73 (8) 239-245 (1977) [17 ref. De, en, fr]

[Landesuntersuchungsanstalt für das Gesundheitswesen Nordbayern, Erlangen, Federal Republic of Germany]

A total of 1292 samples of porcelain ware and 406 of ceramic ware (1431 samples being German-produced, 267 being imported) were tested for release of Pb and/or Cd during holding in contact with a 4% acetic acid solution at 22°C for 24 h in the dark. Tables and diagrams of results are given; the results are evaluated in relation to proposed EEC guidelines (max. 1.0 mg Pb and/or 0.1 mg Cd/100 cm² for flatware, max. 5.0 mg Pb and/or 0.5 mg Cd/100 cm² for hollow ware). Overall, 7.7% of porcelain samples and 4.9% of ceramic samples exceeded these limits for Pb; corresponding values for Cd were 4.6 and 0.5% respectively. A lower proportion of imported than of German samples exceeded the guidelines. Repeated washing of porcelain ware in a washing-up machine tended to cause an increase in Pb and Cd release; with ceramic ware, an initial decrease in heavy metal release was observed, after which values remained approx. constant. Studies on replicate samples of items from the same batch showed considerable variability of Pb and Cd release. Analyses by AAS and differential pulse polarography agreed well.

AJDW

13

Review of European test methods for measuring lead and cadmium release. (In 'Proceedings, International Conference on Ceramic Foodware Safety' [see FSTA (1978) 10 2C21].) [Lecture] Laurs, A. J.

pp. 27-36 (Undated) [En] [Ferro Corp., POB 6088, Van Helmonstraat, Rotterdam 7, Netherlands]

This review includes a table summarizing European testing methods and tolerances by country for Pb and Cd in ceramic ware, and for some countries also for Sb, Zn and Ba. It clearly shows there is still much diversity of opinion. AL

14

Report on the light sensitivity of cadmium release from glazed ceramic tableware. (In 'Proceedings, International Conference on Ceramic Foodware Safety' [see FSTA (1978) 10 2C21].) [Lecture] Carroll, D. M.; Halpin, M. K.

pp. 111-133 (Undated) [10 ref. En] [Inst. for Ind. Res. Standards, Ballymun Road, Dublin, Irish Republic]

Experiments are described which show that the test for Cd can be sensitive to light conditions. 7-in diam. whiteware plates glazed with a Pb-bearing low sol glaze, bearing 2 types of commercial decoration, a band of yellow colour known to be Cd-bearing, or an onglaze silk screen decoration, were used, or, in some experiments, plates with lithograph decoration. Tests carried out were the cold extraction test (CET) (plates were filled (3 filling systems) with 4% v/v solution of acetic acid in deionized water, covered, left at $21 \pm 4^\circ\text{C}$ for 24 h, then Pb and Cd contents were measured by AAS), exposure tests to daylight, UV and artificial light, and CET using N_2 atm, acids other than 4% acetic, or deionized water: results are tabulated. Cd extraction was shown to be dependent on both light and O_2 availability. Various commercial glazes of British and German origin were also compared. AL

15

[Progress in atomic absorption spectrometry of fats.]

Prevot, A.; Gente-Jauniaux, M.; Morin, O.

Revue Francaise des Corps Gras 24 (8/9) 409-418 (1977) [13 ref. Fr, en, de, es] [Inst. des Corps Gras (ITERG), Paris, France]

Recent improvements in AAS instrumentation which have increased its efficiency are outlined, viz. electrodeless discharge lamps, new atomization sources (plasma), tantalum furnaces needed for some elements (Si, Sn), and control of furnace temp. Automatic sample changers for the graphite furnace improved the repeatability and the time for detn. of Fe and Cu in oils. Microcomputers allow automated calibrations. The changes in Fe, Cu and

Ni concn. during oil refining are reviewed, and detn. of As, Cd, Pb, Hg and Mn in fats is described. Compared with other foods, their concn. in fats are extremely low, e.g. < 5-35 parts/billion (ppb) Pb, 9 ppb As and 4.4 ppb Hg in margarine, < 5-10 ppb Pb, < 2 ppb Cd and 2.3-4.1 ppb Hg in vegetable oils, and 40 ppb Pb in virgin olive oil. [From En summ.] RM

16

[Uptake and release of cadmium by the North Sea shrimp.] Untersuchungen zur Aufnahme und Abgabe von Cadmium durch die Nordseegarnele. Dethlefsen, V.

Informationen für die Fischwirtschaft 24 (5) 161-162 (1977) [De] [Inst. für Küsten- & Binnenfischerei, Cuxhaven, Federal Republic of Germany]

Shrimps were held in sea water containing 0.005, 0.010, 0.020, 0.050 and 0.100 mg Cd/l. for 20 days; they were then transferred to Cd-free water. Cd concn. in the tissues were determined at intervals. Shrimps held in water containing 0.100 mg Cd/l. for 20 days had a mean Cd content of 22 mg/kg DM basis. After transfer to Cd-free water, little or no Cd release occurred. This implies that intermittent pollution of the sea with Cd is likely to result in a progressive increase in the Cd content of shrimps. AJDW

17

[Cadmium in fish of the middle and lower reaches of the Neckar: changes since 1973.] Cadmium in Fischen des mittleren und unteren Neckars: Veränderungen seit 1973.

Müller, G.; Prosi, F.

Naturwissenschaften 64 (10) 530-531 (1977) [3 ref. De] [Inst. für Sedimentforschung der Univ., D-6900 Heidelberg, Federal Republic of Germany]

In 1972 the sediment of the middle and lower reaches of the Neckar river near Heidelberg was found to have a high Cd concn. due to discharge of Cd-containing effluent from a pigment factory. Water samples contained ≤ 220 parts/billion (p.p.b.) of Cd. This concn. was higher than the max. value recommended by WHO (10 p.p.b.) for drinking water and the US Federal Water Pollution Control Administration max. level of 5 p.p.b. Cd for irrigation water. Results of a systematic examination of the fish sp. *Leuciscus rutilus* in 1973 showed Cd concn. of < 20 p.p.b. for non-polluted locations, and ≤ 230 p.p.b. at polluted locations. Cd concn. in fish muscle of 22 fish (20 *Leuciscus rutilus* and 2 *Alburnus lucidus*) examined from the polluted area showed a mean Cd value of 37.5 p.p.b. in 1973 with a decrease to 14.4 p.p.b. in 1977 as a result of installation of an effluent-treatment plant at the factory responsible for the pollution. SP

18

[The heavy metals in food crops and in soils.]

Hardh, J. E.

Journal of the Scientific Agricultural Society of Finland 49 (3) 209-220 (1977) [25 ref. Fi, en]

[Inst. of Hort., Univ. of Helsinki, Viik, Helsinki 71, Finland]

The Pb, Cd, Hg, Cu, Zn, Mn, V, As and S contents of lettuce, spinach and carrots grown at different distances from sources of pollution and in non-polluted areas were studied. Forest-grown native edible berries (*Vaccinium myrtillus* and *V. vitis-idaea*) and mushrooms, genera *Boletus* and *Cantharellus*, were also studied. Background Pb levels in soil ranged from 2.5 to 8.9 mg/kg DM. Pb contents of lettuce, spinach and carrots grown in the same soils were 0.15-3.58, 0.75-2.19, and 0.31-1.74 mg/kg DM, resp. Pb content of mushrooms grown in polluted areas was ≤ 149.9 mg/kg DM. Lettuce had the highest metal contents of vegetables tested and mushrooms had the highest metal content of native edible plants. Liming diminished Cd content of lettuce; K and Mg fertilization did not have any effect. Rinsing of lettuce 5 times in water reduced the Cd content by 44%. No marked differences between spp. were seen in Hg contents of the plants studied; the highest levels were in the polluted areas. Lettuce and spinach had higher Cu contents than carrots, and mushrooms had the highest of all plants studied. As contents were 0.11-2.68, 0.95-1.75, 0.09-2.90, 0.15-0.61 and 0.20-0.95 mg/kg DM for lettuce, spinach, carrots, berries and mushrooms resp. S, Mn and V contents are also given. [From En summ.] SP

19

[Origins of trace contents of heavy metals in foods and feeds.] Ursachen von Schwermetallspuren in Lebens- und Futtermitteln.

Steinle, G.

Zucker 30 (10) 535-540 (1977) [45 ref. De, en, fr] [Zentral-Lab. der Süddeutschen Zucker-AG, Wormser Strasse 1, 6719 Obrigheim 5, Federal Republic of Germany]

The increase of heavy metal pollution in the soil and plants, and hence in foods of plant and animal origin is discussed. Using published and own data the author presents values for As, Pb, Cd, Hg, Cr, Cu, Mn, Zn, Co, Ni, Mo and Se contamination in water, soil, sugar beets and sugar factory products. RM

20

Trace metal species in fresh waters.

Florence, T. M.

Water Research 11 (8) 681-687 (1977) [23 ref. En] [Analytical Chem. Sect., Australian Atomic Energy Commission, Res. Establishment, Lucas Heights, NSW, Australia]

A recently proposed trace metal speciation scheme was applied to the detn. of the chemical forms of Cu, Pb, Cd and Zn in 4 natural fresh waters and a tap water. Studies were also made on

the reliability of the technique and of the effect of various methods of storage on the speciation results. The measurements showed that Cu in the river and reservoir samples was associated mainly with organic matter, probably organic colloids; Pb was divided between stable inorganic and organic forms, but 1 particular inorganic Pb sp. predominated; Cd existed almost entirely as labile ionic forms; Zn was divided between labile ionic spp. and a stable inorganic form, very little Zn was associated with organic colloids; and the trace metals were not combined with inorganic colloids. Samples stored in polyethylene containers for >3 wk at 25°C or 4°C showed little change in either total metal concn. or metal speciation. Freezing, however, caused some irreversible changes. AS

21

[Carbon rod atomic absorption for intact-cell systems and biological tissues.]

Fujiwara, K.; Umezawa, Y.; Numata, Y.; Fuwa, K.; Fujiwara, S.

Japan Analyst [Bunseki Kagaku] 26 (10) 735-737 (1977) [1 ref. Ja, en] [Dep. of Chem., Univ. of Tokyo, Tokyo, Japan]

Direct atomization without pretreatment for analysis of trace metals in intact cell systems including beef liver by C rod AAS was investigated. Tabulated results agreed fairly well with National Bureau of Standards values, suggesting that the method is useful thanks to its high sensitivity, rapidity, exclusion of contamination during pretreatment and applicability to very small samples. [From En summ.] RM

22

[Effect of certain analysis factors on results of simultaneous determination of lead, zinc, copper and cadmium by atomic absorption spectrophotometry in selected food products. II. Effect of associated elements, rectilinearity of standard curves and calibration methods.] Brzozowska, B.

Roczniki Panstwowego Zakladu Higieny 28 (4) 355-361 (1977) [9 ref. Pl, ru, en] [Zaklad Badania Zywnosci i Przedmiotow Uzytku, Panstwowy Zaklad Higieny, Warsaw, Poland]

Presence of other elements significantly affected results of simultaneous AAS determination of Pb and Cd (but not Cu and Zn) in tomato juice, mixed-vegetable juice and milk samples prepared by ashing. Addition of salts reduced the absorbance of standard solutions of Pb. For detn. in the rectilinear range of standard curves, using the Unicam SP90A spectrophotometer, measurements were restricted to <0.3 units of absorbance. For detn. of Pb and Cd in aqueous solutions of ash, using this spectrophotometer, calibration by addition of a standard is recommended. In detn. of Cd added to milk at 2-20 µg/l., this calibration method gave recoveries of 90-125%. Calibration with a standard curve based on an artificial ash solution gave recoveries of 75-100%, as did also calibration with a standard curve plotted without allowance for the

matrix. For vegetable juice, however, these last 2 calibration methods gave recovery rates of 100-200%. [See FSTA (1978) 10 1A35 for part I.] ADL

23

Differential-pulse polarographic determination of heavy metals released from ceramic glazes. Buldini, P. L.

Analyst 102 (1221) 921-928 (1977) [17 ref. En] [CNR Lab. for Ceramic Tech., 48018 Faenza, Italy]

Inorganic oxides are commonly used for glazing ceramic ware and may contaminate food and beverages. Pb, Zn and metals used for colouring purposes (e.g. Cd, Cr, Co, Cu, Fe, Mn and Ni) are leached from glazed ceramic surfaces with 4% v/v acetic acid over a 24-h period at room temp. The released metal ions are determined simultaneously in acetic acid or acetate buffers by means of differential-pulse polarography. The influence of some parameters, e.g. pH variation or the presence of surfactants, is shown. Calibration graphs are linear over the range 0-500 µg/ml. The proposed method is simple and allows easy detn. of 0.5 µg/ml of Co²⁺, 0.3 µg/ml of Cr³⁺, 0.1 µg/ml of Pb, Ni²⁺ and Fe³⁺, and 0.05 µg/ml of Cd, Cu, Zn and Mn³⁺, with a precision of ±2-3%. AS

24

[Accumulation of toxins in experimental food chains: example of cadmium.]

Jouany, J.-M.; Ferard, J.-F.; Mugel, M.

Annales des Falsifications et de l'Expertise

Chimique 70 (755/756) 459-468 (1977) [6 ref. Fr] [Lab. d'Ecotoxicologie, Univ. de Metz, Cloître des Recollets, 57000 Metz, France]

A study of the effect of Cd in the aquatic chain algae (*Chlorella vulgaris*) - crustacea (*Daphnia magna*) - fish (bleak, *Leucaspis delinatus*) was carried out with (i) high concn. or (ii) low concn. In method (i) 100 daphniae were put into a culture of *Chlorella* grown for 5 days in a medium containing 500 µg Cd/l., and after 7 more days the amount of Cd in the daphniae was measured, using Boudene's method of mineralization (12 h at 65°C with HNO₃) followed by AAS. 1 bleak was then put into the medium, and after 24 h its Cd content was likewise measured. In method (ii), taking 24 days vs. 13 days for method (i), the original medium contained only 10 µg Cd/l. Results of method (i) showed the growth of *Chlorella* was inhibited by 16% compared with the control; there was a 35% mortality rate of the daphniae and the growth of the survivors was reduced (wt. at 7 days 65 µg vs. 165 µg (control)); the fish was unaffected. Amounts of Cd measured in the 2 methods were: *Chlorella* (i) 875, (ii) 30, control 3.5 ng/mg dry wt.; daphniae (i) 250, (ii) 53, control 12 ng/mg; and bleak (i) 25, (ii) 2, control 0.2 ng/mg. It was concluded that because of the cumulative effect, there is a potential danger from even small concn. of Cd in water. KME

25

[Transfer of heavy metals in the baking chain.]
Bittel, R.; Fourcy, A.; Godon, B.; Mourioux, G.
Annales de Technologie Agricole 26 (2) 189-198
(1977) [12 ref. Fr, en] [Dep. de Protection,
Commissariat à l'Energie Atomique, BP No. 6,
92260 Fontenay-aux-Roses, France]

Data are given for concn. of heavy metals
(including Mg, Zn, Fe, Cu, Cd, Sr, Pb, Co, Mo and
Hg) in wheat (grown on soils subjected to various
fertilizer treatments), flour, bran, dough, bread, and
yeast, salt and water used in breadmaking. The
results show that the flour is the main source of
heavy metals in bread. A large proportion of the
heavy metal content of wheat is present in the husk,
and is removed in the bran fraction during milling
of white flour. AJDW

26

[Process for solubilizing biomaterials.]
Aufschlussverfahren für Biomaterialien.
Iwantschew, G.; Scheubeck, E. (Siemens AG)
German Federal Republic Patent Application 2
605 560 (1977) [De]

Food products, especially meat, are solubilized in
<30 min to facilitate examination for traces of metal
by X-ray fluorescence analysis, by predrying an
amount of approx. 20 g product at 110°C and 20
mbar to a residual moisture content of 5-10%, and
then disintegrating it by combustion in O₂ at 30-40
bar. The liquid phase, made up of the condensate
obtained during drying and of the products of
combustion, contains all the traces for which the
product is to be tested. The process permits rapid
testing of food products without requiring the
addition of any chemicals. W&Co

27

A procedure for simultaneous determination of
arsenic, cadmium, copper, tin and zinc in beef
extract by neutron activation analysis.
Korob, R. O.; Cohen, I. M.; Lage, M.; Mila, M. I.
Journal of Radioanalytical Chemistry 42 (1) 121-
132 (1978) [19 ref. En] [Comision Nacional de
Energia Atomica, Direccion de Operaciones,
Avenida del Libertador 8250, Buenos Aires,
Argentina]

Samples of beef extract are irradiated in quartz
ampoules for 8 h, and after 48 h decay are washed
with HNO₃ and water, dried and cooled with liquid
N. Samples are then separated radiochemically
using HNO₃ and H₂SO₄. As, Cd, Cu, Sn and Zn
carriers are added. Filtrates are washed with HCl
for As and Cu detn., and passed in a stream of H₂S
for Cd, Cu, Sn and Zn detn. Measurements are
carried out with a NaI (TI) detector. Results show
As concn. ranged from 39 to 160 × 10⁻³ p.p.m., Cd
concn. from 0.6 to 9.6 × 10⁻³ p.p.m., Cu concn.
from 0.51 to 0.91 p.p.m., Sn concn. from 0.7 to 7.9
p.p.m. and Zn concn. from 10.9 to 18.8 p.p.m.
SP

28

[The plasma torch: application to problems linked
to the environment.]

Leroy, M. J.-F.; Sutter, E. M. M.
*Annales des Falsifications et de l'Expertise
Chimique* 70 (755/756) 401-409 (1977) [11 ref.
Fr, de, en] [Lab. de Chimie Minerale, Ecole Nat.
Superieure de Chimie, 1 Rue Blaise-Pascal, 67008
Strasbourg, Cedex, France]

The plasma torch, newly developed for analytical
spectroscopy, offers great advantages in detecting
fractional amounts of metals in foodstuffs. It
reaches higher temp. than other flame spectrometry
devices (> 6000° K) and can thus identify elements in a
range from ng/ml to hundreds of µg/ml, enabling
major and minor elements in samples in solution to
be determined simultaneously. Various plasma
emission sources (plasma arcs or jets from
electrodes; high frequency induced plasma) are
discussed, the plasma torch is illustrated and
described in detail, and tables are given comparing
limits of detection of various spectroscopic
methods. KME

29

Leaching of pewterware by organic acids.
Gould, J. H.

*Journal of the Association of Official Analytical
Chemists* 60 (6) 1408-1413 (1977) [19 ref. En]
[FDA, Div. of Chem. & Physics, Washington, DC
20204, USA]

3 pewter goblets were repeatedly leached by
acetic, citric, lactic, malonic, and tartaric acid
solutions. The solutions each had the same carboxyl
group normality as 4% acetic acid. The leach
solutions were periodically analysed for Pb, Cd, Cu,
Bi, Sb and Sn by AAS. Analysis of the leach
solutions showed that, without the addition of nitric
or perchloric acid to the acetic and malonic acid
leach solutions, Pb precipitated from the solutions
on standing. Addition of the mineral acids
redissolved the precipitate. Pb, Cd and Bi were
found in higher concn. in the leach solution than in
the alloy; Cu and Sb were less concn. in the leach,
while the amount of Sn was approx. equal in both.
Tartaric acid solution dissolved about 9 × as much
metal from the pewter as the other organic acids
but removed less Pb than acetic or malonic acids.
None of these samples tested exceeded the FDA
standards for Pb or Cd release. AS

30

[Cadmium in mushrooms.] Cadmium in Pilzen.
Seeger, R.

*Zeitschrift für Lebensmittel-Untersuchung und -
Forschung* 166 (1) 23-34 (1978) [26 ref. De, en]
[Inst. für Pharmakologie & Toxikologie der Univ.,
Versbacher Landstrasse 9, D-8700 Würzburg,
Federal Republic of Germany]

Cd content of 402 spp. of wild mushrooms was
determined by flameless AAS and results are

tabulated. Altogether 1049 samples, grown mainly in southern Germany, were tested. The Cd content was between <0.1 and $120 \text{ mg/kg dry wt.}$, equivalent to <0.01 and $10.8 \text{ mg/kg fresh wt.}$ Samples with low Cd content were predominant: 68% of the samples contained $<2 \text{ mg/kg dry wt.}$, 86.5% contained $<5 \text{ mg/kg dry wt.}$, equivalent to about <0.2 and $<0.5 \text{ mg/kg fresh wt.}$, resp. The Cd content was clearly sp.-dependent, and to a lesser extent genus-dependent. Samples containing $>10 \text{ mg/kg dry wt.}$ occurred in 41 spp., among these were 9 Tricholomataceae, 10 Agaricaceae, 11 Cortinariaceae, 3 Amanitas and 4 Russula spp. Samples containing $>50 \text{ mg/kg dry wt.}$ were found in *Agaricus augustus*, *A. perrarus*, *A. silvicola*, *A. macrosporus*, *A. maleolens*, and *Inocybe bongardii*. In single fruiting bodies the lowest Cd content was found in the stem, whereas the highest content was found in the gills and tubes. Cd content of the gills was at most $5 \times$ the amount present in the cup. In Cd-rich mushrooms a marked concn. as compared with the Cd content of the soil had occurred. AS

31

Solubility and availability of cadmium in cadmium-sludge amended soil.

Street, J. J.

Dissertation Abstracts International, B 37 (12) 6042-6043: Order No. 77-12068, 126pp. (1977) [En] [Colorado State Univ., Fort Collins, Colorado 80521, USA]

Field studies of Cd availability to plants showed that heavy applications of sewage containing Cd increased Cd concn. in grain sorghum and wheat as compared to control plots. DIH

32

Determination of heavy metals in seawater and marine organisms by flameless atomic absorption spectrophotometry. VI. Cadmium determination in culture waters from toxicological experiments with marine organisms.

Sperling, K.-R.

Zeitschrift für Analytische Chemie 287 (1) 23-27 (1977) [51 ref. En, de] [Biol. Anstalt Helgoland, Wüstland 2, D-2000 Hamburg 55, Federal Republic of Germany]

Direct flameless AAS was adapted for the detn. of Cd in culture water from toxicological experiments with marine organisms by addition of $(\text{NH}_4)_2\text{S}_2\text{O}_8$ (peroxodisulphate) and H_2SO_4 , and a routine method was developed. The sensitivity of the method was $0.01 \mu\text{g Cd/l.}$ with mean deviation 2.2%. [See FSTA (1977) 9 7R358 for part IV.] RM

33

Atomic absorption spectrophotometric determination of lead, cadmium, zinc, and copper in clams and oysters: collaborative study.

Capar, S. G.

Journal of the Association of Official Analytical Chemists 60 (6) 1400-1407 (1977) [7 ref. En] [FDA, Div. of Chem. & Physics, Washington, DC 20204, USA]

In the method studied by 14 collaborators, clams and oysters are dry ashed at 475°C , the ash is dissolved in dil. HNO_3 , and Pb, Cd, Zn and Cu are determined by flame AAS. Sample solutions containing levels of Pb and Cd too low for direct AAS are extracted as the 1-pyrrolidinecarbodithioate complex into n-butyl acetate before AAS. Concn. ranges in the samples studied were: Pb, 0.06-2 p.p.m., Cd, 0.03-2 p.p.m., Zn, 40-600 p.p.m., and Cu, 5-50 p.p.m. Within these ranges, Cd levels $<0.5 \text{ p.p.m.}$ and Pb at all levels required extraction prior to AAS. The average coeff. of variation for Pb, Cd, Zn and Cu were, resp., 66.0, 93.2, 8.5 and 20.5% for the lowest levels and 13.5, 3.8, 6.7 and 6.8% for the highest levels. Recoveries were computed by using the sum of the average collaborative results for the totally unfortified samples plus the fortification levels as the expected concn. The average recoveries of Pb, Cd, Zn and Cu were, resp., 94.0, 99.7, 99.3 and 100.2% for the lowest fortification level and 94.8, 95.6, 96.5 and 97.5% for the highest level. High levels of Cu and/or Zn caused incomplete extraction of Pb and Cd, with Cd being affected more severely than Pb. Background corrections may be needed for determining Zn and Cd with the direct aspiration technique. No recommendation is made for official action. AS

34

[Some content standards and methods of determination of trace elements in foods.]

Wereszczynska-Cislo, B.

Przemysł Spożywczy 31 (11) 412-414 (1977) [21 ref. Pl, ru, en, fr, de]

This article reviews published information on the topics named in the title and includes tabulated literature data on max. tolerance for contents of 13 trace elements in wine in France, UK, Canada, Federal Republic of Germany and Italy, and those proposed by IOV and by J. Schneider; and on heavy metal contents of 14 kinds of fruit juice. SKK

35

A comparison of chemical methods for estimating Cd, Pb, and Zn availability to six food crops grown in industrially polluted soils at Odda, Norway.

Lag, J.; Elsokkary, I. H.

Acta Agriculturae Scandinavica 28 (1) 76-80 (1978) [19 ref. En] [Dep. of Soil Science, Agric. Univ. of Norway, As-NLH, Norway]

The edible parts of 6 different plant crops, potatoes, carrots, cabbage, barley, parsley and lettuce, grown in polluted soils in Odda, Norway, were analysed for Cd, Pb, and Zn. Various solvents were used for the extraction, including: 1.0N and 0.1N HCl, 1.0 and 0.1N HNO_3 , 2.5% acetic acid,

1N ammonium acetate pH 7, 1N ammonium acetate pH 4.8, ammonium lactate solution, acid ammonium oxalate and 0.05M EDTA, and their efficiency was compared. Correlations of the analytical values of Cd, Pb and Zn in the plant crops with those in their respective soils showed that most of the tested reagents could be considered, to a varying degree, reliable for use, in analysis for the metals studied. 1.0N HNO₃ solution had the greatest efficiency. SP

36

Anodic stripping voltammetry with collection at tubular electrodes for the analysis of tap water.

Schieffer, G. W.; Blaedel, W. J.

Analytical Chemistry 50 (1) 99-102 (1978) [8 ref. En] [Dep. of Chem., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

Portable, battery operated equipment is described, tested, and characterized for the performance of anodic stripping voltammetry with collection (ASVWC) at 2 Hg-coated glassy carbon tubular electrodes in series. By operating the collection electrode at a constant cathodic potential, charging current backgrounds are reduced greatly, permitting better perception of peak currents than with conventional ASV. The equipment is applied to the analysis for Cd, Pb and Cu in tap water at subnanomolar levels. AS

37

[Microbiological and chemical characterization of enzyme preparations.]

Burzynska, H.; Urbanek-Karlowska, B.; Fonberg-Broczek, M.; Kwast, M.

Roczniki Panstwowego Zakladu Higieny 28 (5) 425-434 (1977) [14 ref. Pl, ru, en] [Zaklad Badania Przedmiotow Uzytku, PZH, Warsaw, Poland]

A total of 39 samples of enzyme preparations consisting of 27 samples of *Bacillus subtilis* protease and amylase preparations imported from Denmark and Netherlands and obtained by Polish provincial sanitary-epidemiological stations during brewery control and 12 samples of *B. subtilis*, *Aspergillus niger*, *Mucor miehei* and papain preparations presented by the manufacturers were examined. Counts of aerobic microorganisms, and moulds and yeasts, and titres of coliforms, enterococci, and anaerobic bacilli were obtained, antibiotic activities were assessed; enzyme activities were measured; and contents of Zn, Cu, Pb, and Cd were determined. Results are tabulated for some or all of the preparations. The main conclusions were that the microbiological quality of the preparations was well within the prescribed standards; that 1% and 2% solutions of 31 of the preparations showed no antibiotic properties, but that 10% solutions or undiluted preparations inhibited growth of some test strains; and that heavy metal contents were within the normal range. SKK

38

[Heavy metals in foods - analytical studies in Austria.] Schwermetalle in der Nahrung - Analytische Kontrolle in Österreich.

Woidich, H.; Pfannhauser, W.

Nahrung 21 (8) 685-695 (1977) [De, en, ru]

[Forschungsinst. der Ernährungswirtschaft, Vienna, Austria]

AAS studies on concn. of Pb (1500 samples), Cd (800 samples) and Hg and As (1200 samples) in a wide range of foods, including meat products, fish products, fruit, vegetables, cereal products, dairy products, water, beverages and fats, are described. Tables of mean values and ranges are given. Max. heavy metal concn. recorded were (p.p.m.) Pb 0.990 (sardines); Hg 3.22 (*Boletus edulis*); As 29.6 (eel); and Cd approx. 1.0 (mussels). On the basis of analytical data and values for food consumption patterns in Austria, per capita monthly intakes of these heavy metals are estimated; estimates for Pb, Hg and As are below the FAO/WHO recommended limit, whereas estimates for Cd are slightly above this limit. AJDW

39

[Effect of motorway and industrial pollution on the contents of cadmium, lead, mercury, zinc and copper in grain.]

Bulinski, R.; Kot, A.; Kutulas, K.; Szydlowska, E. *Bromatologia i Chemia Toksykologiczna* 10 (4) 395-399 (1977) [16 ref. Pl, en, ru] [Inst. Analizy i Tech. Farmaceutycznej Akad. Med., Lublin, Poland]

The contents of Cd, Pb, Hg, Zn and Cu were determined in samples of wheat and rye grown 10 and 200 m from a major highway and at 1 and 2 km from various factories (cement, dyestuffs, truck-producing); wheat and rye grown 15-20 km away served as 'unpolluted' controls. Mean values (mg/kg) for the cereals grown in 'unpolluted' and 'polluted' areas, resp., were: Cd, 0.056 and 0.134 for rye and 0.050 and 0.101 for wheat; Pb, 0.053 and 0.204 for rye and 0.057 and 0.212 for wheat; Hg, 0.0019 and 0.0033 for rye and 0.0018 and 0.0042 for wheat; Zn, 14.99 and 27.82 for rye and 18.03 and 35.55 for wheat; and Cu, 3.50 and 3.27 for rye and 3.84 and 3.28 for wheat. Thus, only Cu was unaffected by proximity to the sources of pollution, all the other metals showing considerable increases in concn. HBr

40

[Feeding trials with freshwater fish using diets containing added heavy metals.] Fütterversuche an Süßwasserfischen unter Schwermetallzusatz.

Jacobs, G.

Informationen für die Fischwirtschaft 25 (1) 31-32 (1977) [3 ref. De] [Inst. für Biochem. & Tech., Hamburg, Federal Republic of Germany]

Trout and carp were used in feeding trials with diets artificially contaminated with Hg or Cd. A diet containing 1.02 p.p.m. Hg as methylmercuric chloride gave Hg contents in trout muscle of 0.29-

0.67 p.p.m.; a diet containing 9.8 p.p.m. Hg as HgCl_2 gave a Hg concn. of only 0.03 p.p.m. in muscle tissue; and a diet containing 16 p.p.m. Cd (as CdCl_2) gave a Cd concn. of 0.06 p.p.m. in trout muscle tissue (vs. ≤ 0.02 p.p.m. in controls). Results of trials with carp were as follows: a diet containing 0.16 p.p.m. Hg as methylmercuric chloride gave muscle concn. of ≤ 0.1 p.p.m. Hg; a diet with 10.98 p.p.m. Hg as methylmercuric chloride gave Hg concn. of 4-5.6 p.p.m. in the muscle; and a diet containing 12.41 p.p.m. Cd (as CdCl_2) gave Cd concn. of only ≤ 0.04 p.p.m. in the muscle tissues (vs. 0.01-0.03 p.p.m. Cd in control samples). AJDW

41

[Effect of various analytical factors on the results of simultaneous determination of lead, zinc, copper and cadmium by atomic absorption spectrophotometry in selected food products. III. Method for simultaneous determination of lead, cadmium, copper and zinc in juices and milk.] Brzowska, B.

Roczniki Państwowego Zakładu Higieny 28 (5) 441-449 (1977) [Pl, ru, en] [Zakład Badania Żywności i Przedmiotów Użytku, PZH, Warsaw, Poland]

On the basis of finding reported in parts I and II [see FSTA (1978) 10 1A35 and 4A244], simultaneous estimation of Pb, Cd, Cu and Zn in samples of orange juice, mixed-vegetable juice and milk was studied. It was found that using 1 batch of ashed material, Pb and Cd could be determined by AAS by the internal standard method and Cu and Zn could be determined by the standard curve method. Sensitivity and accuracy of the methods are discussed. Mean values for contents of Pb in 2 samples of orange juice, 1 of mixed-vegetable juice, and 1 of milk were resp. (mg/l.): 0.250, 0.250, 0.160 and 0.060; and for Cd they were resp. (µg/l.): 26, 23, 9 and 20. For contents of Cu in 2 samples of orange juice, 1 of mixed-vegetable juice and 2 of milk the values were resp. (mg/l.): 0.152, 0.055, 0.800, 0.185 and 0.107; and for Zn they were resp. (mg/l.): 0.53, 0.34, 1.37, 4.25 and 3.78. Cu and Zn could also be determined in unsweetened fruit or vegetable juices without previous mineralization. SKK

42

A study of selected heavy metals in the Grand Calumet River-Indiana Harbor Canal system. Romano, R. R.

Dissertation Abstracts International, B 38 (2) 570-571; Order No. 77-15464, 221pp. (1977) [En] [Purdue Univ., West Lafayette, Indiana 47907, USA]

Measurements of heavy metal content of a river-canal system showed that large amounts are transported into Lake Michigan: Cd 1.1 ± 0.3 ; Pb 21 ± 5 ; Zn 83 ± 15 ; and Fe 1090 ± 180 (tons/yr ± 1 s.e.). This may affect domestic water supplies of cities. DIH

43

The distribution and effects of selected heavy metals in a contaminated lake.

Bishop, W. E.

Dissertation Abstracts International, B 38 (2) 567; Order No. 77-15379, 160pp. (1977) [En] [Purdue Univ., West Lafayette, Indiana 47907, USA]

The contaminated lake (Little Center Lake, in N.E. Indiana, USA) contained Cd, 3.2 µg/l.; Zn, 139 µg/l.; and Pb, 18 µg/l. Cd, Zn and Pb concn. in bluegill and pumpkinseed (*Lepomis gibbosus*) fish were significantly higher than those in fish from uncontaminated lakes. DIH

44

Distribution of heavy metals in the northern shrimp *Pandalus borealis* from the Oslo fjord.

Neelakantan, B.

Fishery Technology 13 (1) 20-25 (1976) [10 ref. En] [Inst. of Marine Biol., Univ. of Oslo, Oslo, Norway]

Samples of the shrimp *Pandalus borealis* were collected at 6 sites in Oslo fjord, (Mokkalasene, Elle, Holmestrandsfjord, Bolarne, Faerder and Torbjørnskjær) during Jan.-March 1973, and analysed for Cu, Cd, Zn and Hg. Tables of results are given showing moisture, contents, heavy metal concn. at the locations studied, moisture and heavy metal contents subdivided according to the body length of the shrimps, and moisture and heavy metal contents of individual tissues. Mean concn. of the individual heavy metals were (µg/g DM): Cu 95, Cd 0.9, Pb 2.7, Zn 103, and Hg 0.4. Concn. of all heavy metals studied were higher in the inner and middle fjord than in the outer fjord. Sex and body size seemed to significantly influence Pb and Zn concn., but not Cu, Cd or Hg concn. Considerable differences in heavy metal concn. between individual tissues were observed, hepatopancreas, gills and eggs generally having the highest levels (except that eggs have low concn. of Cu and Hg). Muscle has a relatively low heavy metal concn. AJDW

45

Heavy metals in cultivated oysters (*Crassostrea commercialis*-*Saccostrea cucullata*) from the estuaries of New South Wales.

Mackay, N. J.; Williams, R. J.; Kacprzac, J. L.; Kazacos, M. N.; Collins, A. J.; Auty, E. H.

Australian Journal of Marine and Freshwater Research 26 (1) 31-46 (1975) [17 ref. En] [New S. Wales Fisheries Branch, Box 30 GPO, NSW 2001, Australia]

Concn. of Cu, Zn, Cd, Pb and As were determined in oysters (20 per sample) (i) from 19 important production areas at 1.5, 2.5 and 3.5 yr old, and (ii) from 5 sites in the Georges River. Results of chemical and statistical analysis are shown graphically and in tables. The mean, min. and max. concn. of the 5 metals (ppm wet wt.) for

(i) were respectively: 20 (3-48), 277 (80-665), 0.2 (0.1-1.0), 0.8 (0.3-1.3) and 1.2 (0.3-3.4), i.e. well within the National Health and Medical Research Council recommendations of 30, 1000, 2.0, 2.0 and 1.14 (except for 10 Cu homogenates and 2 As concn. of 3.1 and 3.4 in an area with no known industrial pollution). The Cu, Zn and Cd concn. decreased with increasing wet wt. and age, but total amounts increased, e.g. mean Cu concn. from 37.9 ppm at 5 yr to 34.5 at 2.5 and 27.3 at 3.5 yr, Cd from 0.34 to 0.21 and 0.21, respectively. In oysters sampled from a single estuary, a gradient of increasing metal concn. was observed with increasing distance upstream from the sea. The variability of metal concn. in oysters is discussed and a sampling method suggested for monitoring the levels. RM

46

Cadmium: a sombre picture.

Cooper, P.

Food and Cosmetics Toxicology 15 (5) 478-480 (1978) [En] [British Ind. Biol. Res. Ass., Woodmansterne Rd., Carshalton, Surrey SM5 4DS, UK]

Recent work relating to the toxic nature of Cd is reviewed under the following headings: 'Itai-itai' disease; lungs and kidneys in occupational exposure; hypertension; and measurement of Cd in tissues. VJG

47

Development of a behavioral model for the detection of food toxicants of natural and accidental origins.

Squibb, R. E.

Dissertation Abstracts International, B 38 (5) 2109: Order No. 77-25022, 126pp. (1977) [En] [Rutgers Univ., New Brunswick, New Jersey 08903, USA]

The behavioural model developed employs voluntary running wheel activity by rats. Preliminary developmental work indicated that body wt. losses resulting from deficit amounts of a balanced diet significantly induced ($P < 0.02$) higher levels of running wheel activity over reference controls; however, similar wt. losses produced solely by decrements of corn oil energy failed to induce such hyperactivity. Means of obtaining constant body wt. and baseline levels of running wheel activity are outlined. These baselines permit both hyper and hypo response readouts to dietary doses of a test toxicant when substituted into the restricted regimens. Trials using dioscin saponin (a natural toxicant) and Cd (an accidental toxicant) are reported. It is claimed that, while hyper reactions to toxicants may be revealed immediately, hypo responses (with respect to baseline control values) more accurately reflect the adverse nature of a test material. JA

48

Analytical aspects of mercury and other heavy metals in the environment. [Book]

Frei, R. W.; Hutzinger, O. (Editors)
vii + 196pp. ISBN 0-677-15890-4 (cloth) (1975) [many ref. En] London, UK; Gordon and Breach Science Publishers Ltd. Price £16.70 [Pharmaceutical Dep., Sandoz Ltd., Basel, Switzerland]

This book should prove useful to scientists not well acquainted with heavy metal pollutants or those working in areas which make use of heavy metal analysis such as biology, geology, oceanography, medicine toxicology and pharmacology. Papers included are: Use of mercury in agriculture and its relationship to environmental pollution, by J. G. Saha & K. S. McKinlay (pp. 1-20, 78 ref.), including Hg residues in cereals, fruit, tomatoes, potatoes, meat and eggs, and fish; The microdetermination of mercury and organomercury compounds in environmental materials, by J. F. Uthe & F. A. J. Armstrong (pp. 21-53, 238 ref.); Determination of trace levels of mercury in effluents and waste-waters, by K. H. Nelson, W. D. Brown & S. J. Staruch (pp. 77-88, 8 ref.); A radiochemical method for selective determination of traces of lead, by J. Sary & K. Kratzer (pp. 105-110, 6 ref.); Determination of lead, cadmium, copper and zinc in biological materials by anodic stripping polarography, by I. Sinko & L. Kosta (pp. 111-122, 12 ref.) including bovine liver, kale and carrots; Determination of traces of antimony by flameless atomic absorption spectroscopy, by B. E. Schreiber & R. W. Frei (pp. 123-130, 19 ref.); Determination of some transition metals (including Cd, Cu and Zn in tap water) by atomic absorption spectroscopy after extraction with pyridine-2-aldehyde-2-quinolyl-hydrazone, by R. W. Frei, T. Bidleman, G. H. Jamro & O. Navratil (pp. 131-139, 10 ref.); and The determination of trace transition elements in biological tissues using flameless atom reservoir atomic absorption, by D. A. Segar & J. L. Gilio (pp. 141-151, 26 ref.), including Ag, Cd, Co, Cu, Fe, Mn, Ni, Pb, V and Zn. VJG

49

Availability of cadmium from lettuce leaves and cadmium sulfate to rats.

Welch, R. M.; House, W. A.; Campen, D. R., van
Nutrition Reports International 17 (1) 35-42 (1978) [24 ref. En] [US Plant. Soil & Nutr. Lab., Agric. Res. Service, USDA, Ithaca, New York 14853, USA]

The availability of Cd in lettuce leaves and in cadmium sulphate to male rats were studied. Both Zn-depleted and Zn-adequate rats were fed single doses of either ^{109}Cd -labelled cadmium sulphate or ^{109}Cd -labelled lettuce leaves. Lettuce plants (*Lactuca sativa*, var. 'Black Seeded Simpson') were grown in ^{109}Cd -labelled nutrient solutions that contained either 0.045 or 0.225 p.p.m. Cd and either 0.131 or 0.654 p.p.m. Zn. Increasing Cd

supply to the plants increased Cd concn. in the leaves but had no effect on leaf Zn levels. Increasing Zn supply to the plants increased Zn concn. in the leaves and decreased Cd levels in leaves of plants supplied the higher level of Cd. Cd availability, as indicated by % of ^{109}Cd absorbed, was greater from lettuce leaves than from cadmium sulphate. Absorption of ^{109}Cd depended on the source, and averaged from 1.6 to 4.7% of the dose in Zn-depleted rats and from about 0.9 to 1.2% of the dose in Zn-adequate rats. Increasing the amount of Zn in leaves of plants supplied the higher level of Cd decreased the availability of Cd in the leaves to Zn-depleted rats. AS

50

Heavy metals, selenium and arsenic in nine species of Australian commercial fish.

Bebbington, G. N.; Mackay, N. J.; Chvojka, R.; Williams, R. J.; Dunn, A.; Avty, E. H.

Australian Journal of Marine and Freshwater Research 28 (3) 277-286 (1977) [23 ref. En]

[NSW State Fisheries, 211 Kent Street, Sydney, NSW 2000, Australia]

Metals levels were determined in samples of muscle tissue from 9 spp. of commercial fish accounting for about 30% of the commercial catch. 20-30 individuals from each species were analysed for Hg, Cd, Pb, Cu and Zn, and 8-12 for Se and As. Of the 232 fish analysed, 231 had Cd, Pb, Cu and Zn concn. below the National Health and Medical Research Council (NHMRC) standards. 16 specimens of bream, snapper (*Chrysophris auratus*), mullet (*Sciaenops antarctica*), kingfish, Australian salmon and yellowfin tuna had total Hg concn. >0.5 p.p.m. (NHMRC standard), with max. of 1.94 p.p.m. in snapper. These fish accounted for about 7% of the total sampled. Virtually all the Hg was present as methylmercury. Of the 95 fish analysed for As and Se, 20 (21%) had As concn. $>$ the NHMRC standard of 1.5 p.p.m. As_2O_3 (equivalent to 1.14 p.p.m. As), with max. 4.4 p.p.m. in a snapper. The results suggest that metal contents in fish do not constitute a serious health hazard.

RM

51

Evaluation of a method for the determination of total cadmium, lead and nickel in foodstuffs using measurement by flame atomic-absorption spectrophotometry.

Evans, W. H.; Read, J. I.; Lucas, B. E.

Analyst 103 (1227) 580-594 (1978) [22 ref. En]

[Dep. of Ind., Lab. of Gov. Chem., Cornwall House, Stamford Street, London SE1 9NQ, UK]

In the method described, organic matter is destroyed using a wet-digestion procedure and Cd, Pb and Ni are concentrated by chelation with a mixture of ammonium tetramethylenedithiocarbamate and diethylammonium diethyldithiocarbamate and extraction from an acidic solution with 4-methylpentan-2-one; measurement is by flame

AAS. The accuracy of the method is assessed, ionic interferences noted and s.d. calculated both for the method itself and the method in application, for levels likely to be encountered in foods. Confidence intervals and detection limits were deduced from the results obtained for each element. AS

52

Cadmium, lead and nickel content of *Lycoperdon perlatum* Pers. in a roadside environment.

McCreight, J. D.; Schroeder, D. B.

Environmental Pollution 13 (4) 265-268 (1977)

[15 ref. En] [Univ. of Connecticut, Storrs, Connecticut 06268, USA]

The investigation was undertaken because of the growing trend in USA to gather wild edible spp. of fungi, combined with the known contamination of soils and vegetation adjacent to highways and in urban areas with Cd and Pb; the object was to determine whether sporophores of the fungi accumulate Cd, Pb and Ni. 20 specimens of the puffball *Lycoperdon perlatum* Pers. were collected from grassy areas within 23-34 m of a major highway. Some whole sporophores were washed with a detergent-wetting agent to reveal any easily removable surface accumulation of metals. Relative amounts of metals were determined in the peridium, internal gleba and base of individual sporophores. Samples were wet-ashed by nitric-perchloric acid and the analyses were made by AAS. Ni was detected in only 1 sample (concn. 2.37 p.p.m.), Cd and Pb were found consistently on the outer surface or in the gleba with no differences between washed and unwashed samples. The major location of metals was on or in the peridium. In the gleba low amounts of Cd were found consistently, but Pb only once. No Cd or Pb was found in the base of any sporophore. The range of concn. (p.p.m.) in different parts was Cd 0.00-5.34 and Pb 0.00-80.98. It is concluded that the source of metals is via aerial deposition and penetration rather than the soil. ELC

53

[Incidence of toxic heavy metals (cadmium, lead, zinc and mercury in mushrooms.)

Zum Vorkommen von toxischen Schwermetallen

(Cadmium, Blei, Zink und Quecksilber) in Pilzen.

Woggon, H.; Bickerich, K.

Nahrung 22 (3) K13-K15 (1978) [5 ref. De]

[Zentralinst. für Ernährung, Potsdam-Rehbrücke, German Democratic Republic]

The heavy metal contents of wild mushrooms (including *Agaricus arvensis* and *A. bisporus*) were compared with those of cultivated mushrooms. Cd contents were 32.2, 3.75 and 0.30 mg/kg DM, resp. The Pb and Hg contents were also higher in *A. arvensis* than in the cultivated mushrooms, viz. 3.46 vs. 1.38 and 2.94 vs. 0.53 mg/kg, resp. Only for Cd was the tolerance for heavy metals exceeded, viz. by 5-10 \times in the case of *A. arvensis*. Continued, high-level consumption of this var. of wild mushroom is not recommended. IN

54

Chemical analysis and water pollution control in the Clyde catchment.

Best, G. A.

Proceedings of the Analytical Division of the Chemical Society 15 (4) 119-120 (1978) [En]
[Clyde River Purification Board, Rivers House, Murray Road, E. Kilbride, Glasgow G75 8LA, UK]

Within the framework of water pollution analysis, the concn. of pollutants in fish were studied. Regular analyses of flesh and livers show great variations in heavy metal and organochlorine concn. A disturbing aspect is the widespread contamination of fish by polychlorinated biphenyls (PCB), though the PCB levels in sewage sludge from 2 Glasgow sewage works fell from 2.3 to 1.5 mg/kg dried solids, and from 10.0 to 0.7 between 1971 and 1977. RM

55

Heavy metal concentrations in Ontario fish.

Brown, J. R.; Chow, L. Y.

Bulletin of Environmental Contamination and Toxicology 17 (2) 190-195 (1977) [5 ref. En]
[Inst. for Environmental Studies & Fac. of Med., Univ. of Toronto, Toronto, Ontario M5S 1A4, Canada]

Concentrations of Cu, Cd, Pb, Zn and Hg were determined in 90 fish representing 15 spp. taken from Baie du Dore, Lake Huron, and Toronto Harbour, Lake Ontario. Samples were taken from muscle, liver and kidney, and analysed by AAS. Concn. of all metals were higher in fish from Toronto Harbour, which is more heavily polluted, and were similar in different spp. from the same locality. Mean concn. for Baie du Dore samples (p.p.m. wet wt.) were: Cd 0.06, Cu 0.45, Pb 0.19, Zn 4.69, and Hg 0.06; and for Toronto samples: Cd 0.13, Cu 1.93, Pb 1.78, Zn 36.02, and Hg 0.24. JRR

56

The use of biological indicator organisms to monitor trace metal pollution in marine and estuarine environments - a review. [Review]
Phillips, D. J. H.

Environmental Pollution 13 (4) 281-317 (1977) [189 ref. En] [Dep. of Zool., Uppsala, Sweden]

The use of indicator organisms to study trace metal pollution is reviewed, with particular reference to the use of macroalgae, bivalve molluscs and teleosts. It is suggested that macroalgae and bivalve molluscs (especially *Mytilus edulis*) are the most efficient and reliable indicators developed so far, but that the effects of sampling and environmental variables require further study before the results of surveys using biological indicator organisms can be relied upon. Tables show selected values from literature for the concn. of several trace metals in whole soft parts of bivalve molluscs (e.g. *Mytilus edulis*, *Crassostrea* spp., *Ostrea* spp., *Pecten* spp., *Mercenaria mercenaria*) and in fish muscle. AL

57

The determination of trace metals in marine organisms by atomic absorption spectrometry.

Ramelow, G.; Tugrul, S.; Özkan, M. A.; Tuncel, G.; Saydam, C.; Balkas, T. I.

International Journal of Environmental Analytical Chemistry 5 (2) 125-132 (1978) [21 ref. En]
[Dep. of Marine Sci., Middle E. Tech. Univ., Ankara, Turkey]

The application of AAS to the analysis of trace metals in marine organisms is described. Samples (from the sea around Turkey) analysed were turbot, blue fish, white bream, sardine, gilt-head bream, grey mullet, swordfish, mackerel, mussel, shrimp, crab and oyster. Samples were digested with nitric acid. Hg was determined by cold-vapour method and Cd, Pb, Cu, Mn, Zn and Cr by flame atomization or flameless graphite-furnace atomization. Analytical results (1 or 2 samples) of Hg analysis ($\mu\text{g/g}$ fresh wt.) were: turbot, 0.20; blue fish, 0.24 and 0.11; white bream, 1.12 and 1.70; sardine, 0.03 and 0.04; gilt-head bream, 0.30 and 0.29; grey mullet, 0.02; mackerel, 0.09; mussel, 0.03; and oyster, 0.16 (dry wt.). Analytical results of analysis of trace metals ($\mu\text{g/g}$ fresh wt.) were for white bream, sardine, gilt-head bream, grey mullet, horse mackerel, stripped mullet, shrimp, crab (leg) and dried oyster (dry wt.) resp.: Cd, 0.04, 0.02, 0.03, 0.09, 0.17, 0.02, 0.02, 0.03 and 0.27; Pb, 0.61, 0.57, 0.68, 1.36, 1.05, 0.12, 0.34, 0.27 and 0.26; Cu, 1.11, 2.18, 1.20, 1.70, 0.99, 0.68, 1.77, 10.34 and 43.56; Mn, 0.51, 1.63, -, 0.33, 0.63, 0.22, 0.26, 0.29 and -; Zn, 10.6, 6.3, 9.5, 12.2, 4.3, 6.4, 9.3, 39.3 and 460.0; and Cr, 0.58, 0.28, 0.49, 0.10, 0.65, 0.14, 0.33, 0.36 and 3.68. SP

58

Polarographic studies on the nature of cadmium in scallop, oyster, and lobster.

Chou, C. L.; Uthe, J. F.; Zook, E. G.

Journal of the Fisheries Research Board of Canada 35 (4) 409-413 (1978) [17 ref. En, fr] [Dep. of Fisheries & the Environment, Fisheries & Marine Service, Tech. Branch, Halifax, Nova Scotia B3J 2S7, Canada]

Free and bound forms of Cd were determined in raw shellfish by use of differential pulse polarography and AAS. Free Cd is defined by its polarographic peak potential of -0.62 ± 0.02 V (saturated calomel electrode) in solvent-washed ammonium sulphate extracts. Bound Cd was determined by subtracting the free Cd from the total Cd present in the meat. Both scallop (various species) and American lobster (*Homarus americanus*) muscle tissues contain no free Cd. Oyster (various species), on the other hand, had a considerable percentage (approx. 50%) of its total Cd present as free Cd, a phenomena as yet unexplained. The detection limit for free Cd is approx. $0.05 \mu\text{g/g}$ raw tissue. AS

59

[Release of toxicants from ceramic utensils.]

Schadstoffabgabe keramischer Bedarfsgegenstände.
Herrmann, H.-J.

Nahrung 22 (2) 199-203 (1978) [21 ref. De, en, ru] [VE Wissenschaftlich-Tech. Betrieb Keramik (WTK), Meissen, German Democratic Republic]

Aspects discussed include: the danger of leaching of Cd or Pb from the glaze or decoration on ceramic utensils; tolerances for max. permitted Cd and Pb release from ceramics in various countries; test methods with special reference to extraction with 4% acetic acid, either for 24 h at ambient temp. or for 30 min at 100°C; detn. of Cd and Pb in the extracts (by polarography, AAS or the dithizone method), and methods for minimization of the Pb and Cd release capacity of ceramic utensils. IN

60

[Surveillance and evaluation of environmental chemicals with respect to uptake by man, using the heavy metals lead, cadmium and mercury as examples.] Erfassung und Bewertung von Umweltchemikalien im Hinblick auf die Belastung des Menschen, dargestellt am Beispiel der Schwermetalle Blei, Cadmium und Quecksilber.
Lorenz, H.; Käferstein, F. K.

Berichte über Landwirtschaft 55 (4) 772-778 (1977, publ. 1978) [26 ref. De, en, fr] [Zentrale Erfassungs- & Bewertungsstelle für Umweltchem. des Bundesgesundheitsamtes, Postfach, 1000 Berlin (West) 33]

The tasks of the Centre for Surveillance and Evaluation of Environmental Chemicals (ZEBS) of the Federal Health Office in the Federal Republic of Germany are briefly outlined. ZEBS acts as a coordinating centre for various research institutions and is at present collecting data for the preparation of a regulation covering levels of Pb, Cd and Hg in foods. As an example of the need for cooperation in research, the information available on Pb, Cd and Hg contents of mushrooms is briefly reviewed. DIH

61

[Influence of processing on cadmium content of spinach, green beans and peas.] Einfluss der Verarbeitung auf den Cadmiumgehalt in Spinat, Grünen Bohnen und Erbsen.

Bielig, H. J.; Treptow, H.

Berichte über Landwirtschaft 55 (4) 809-816 (1977, publ. 1978) [4 ref. De, en, fr] [Inst. für Lebensmitteltech., Frucht- & Gemüsech., Tech. Univ., Königin-Luise-Strasse 22, 1000 Berlin (West) 33]

The influence of cold or warm washing and blanching on Cd contents of vegetables was investigated. Cd contents (p.p.m., fresh wt.) (i) in raw material, (ii) after 3 cold washes (30 min spinach, 10 min beans and peas), (iii) after 3 cold washes + blanching (4 min winter spinach, 2 min others) (iv) after 3 warm washes (30-32°C, times as for (ii)) and (v) after 3 warm washes + blanching

as in (iii), were for winter spinach (i) 0.121, (ii) 0.069, (iii) 0.054, (iv) 0.055, (v) 0.036; summer spinach (i) 0.379, (ii) 0.296, (iii) 0.443, (iv) 0.257, (v) 0.343; green beans (i) 0.029, (ii) [only 1 wash] 0.020, (iii) 0.016, (iv) 0.014, (v) 0.011; and peas (i) 0.038, (ii) 0.022, (iii) 0.021, (iv) 0.017, (v) 0.017. 0.1 p.p.m. Cd in fresh wt. has been recommended as a max. tolerated level; washing + blanching of some spinach samples could not reduce levels below this. DIH

62

[Content and distribution of heavy metals in cereals and cereal products.] Gehalt und Verteilung von Schwermetallen in Getreide und Getreideprodukten. [Review]

Ocker, H.-D.

Berichte über Landwirtschaft 55 (4) 796-808 (1977, publ. 1978) [51 ref. De, en, fr] [Inst. für Biochem. & Analytik, Bundesforschungsanstalt für Getreide- & Kartoffelverarbeitung, Schützenberg 12, 4930 Detmold, Federal Republic of Germany]

Hg, Cd and Pb contents of cereals and cereal products are reviewed. Data presented graphically or in tables give contents in wheat, corn, oats and barley, and flour and other milling products. In general contents are less than recommended safety levels (Hg 0.03 p.p.m.; Pb 0.5 p.p.m.; and Cd 0.1 p.p.m.), but about 5% of German wheat samples contain >0.1 p.p.m. Cd. A dry dehulling process can reduce Pb, Hg and Cd contents of wheat by 70%, 50% and 10-20%, resp. Milling by-products, especially wheat bran, concentrate Pb and Hg contamination, but milling does not greatly reduce Cd contamination. Baking of bread reduced Hg contents by 10-24%. DIH

63

Comparative study of the composition of the milk from bovine, caprine, and ovine species.

Mathieu, H.; Jaouen, J.-C. le; Luquet, F. M.; Mouillet, I.

XX International Dairy Congress E, 112-114 (1978) [2 ref. En] [Inst. Tech. de l'Elevage Bovin, Paris, France]

Analyses of French milk during 1973-1975 revealed that ewes' milk was by far the richest in minerals, TS, fat, protein and caseins, with considerable increases during lactation. Goats' milk, the least rich, showed approx. the same compositional changes during lactation as cows' milk. Some milk samples were heavily contaminated with F, As and Cd. [See FSTA (1978) 10 10P1408.] ADL

64

Determination of mercury, arsenic and cadmium in fish by neutron activation.

Anand, S. J. S.

Journal of Radioanalytical Chemistry 44 (1) 101-107 (1978) [35 ref. En] [Air Monitoring Sect., Bhabha Atomic Res. Centre, Trombay, Bombay,

India]

Detn. of Hg, As and Cd in fish was carried out by neutron activation followed by chemical separation to remove the interfering activities of Cu, Zn etc. Some common var. of fish from coastal waters of Bombay, and collected from Trombay, Chembur, Sion and Dadar markets, were analysed and results are presented. The ranges and mean contents in the edible tissues of 22 fish samples were (ng/g): Hg, 4.6-282.6 (43.7); As, 68.9-931.2 (543.1); and Cd, 16.1-175.6 (47.3). The average daily intakes of Hg, As and Cd through fish, assuming a daily max. consumption of 6 g/person, are estimated at 262 ng, 3.2 µg and 284 ng, resp., which are below the tolerable daily intake values. A table compares the levels of Hg, As and Cd in fish analysed by various workers in different countries. AL

65

Flameless atomic absorption spectroscopic determination of heavy metals in whole-fish samples.

Okuno, I.; Whitehead, J. A.; White, R. E.
Journal of the Association of Official Analytical Chemists 61 (3) 664-667 (1978) [14 ref. En]
[US Fish & Wildlife Service, Denver Fed. Cent., Denver, Colorado 80225, USA]

Flameless AAS with a C rod atomizer was used to determine Pb, Cd and Cr in whole-fish samples. Samples were dry-ashed, and the metals were separated by solvent extraction with ammonium pyrrolidine dithiocarbamate in methyl isobutyl ketone, and then back-partitioned into an aqueous acid solution for analysis. The back-partitioning step allows a direct comparison of sample solutions with aqueous solutions of the standard. Recoveries of the metals from fortified samples averaged 91% (± 9.6) for Pb and 100% (± 5.6) for Cr at the 0.1-1 p.p.m. level, and 100% (± 13.3) for Cd at the 0.01-0.1 p.p.m. level. AS

66

[Investigations into lead and cadmium contents in samples of meat and organs from poultry.]

Untersuchungen auf den Gehalt an Blei und Cadmium in Fleisch- und Organproben von Geflügel einschliesslich Wassergeflügel.
Holm, J.

Fleischwirtschaft 58 (2) 299-300; 242 (1978) [6 ref. De, en] [Staatliches Veterinäruntersuchungsamt, Dresdenstrasse 6, 3300 Braunschweig, Federal Republic of Germany]

50-100 each of young chickens, broilers, boiling fowls, turkeys, ducks and geese were examined for Pb and Cd residues in meat and kidneys, and in some, also in liver. Samples were prepared by wet digestion with $\text{HNO}_3/\text{HClO}_3$ and analysed by AAS. Toxic metal contents of muscle were slightly high in turkeys, ducks and geese than in fowls. When classifying organs by their toxic metal contents, kidneys of 1.4% of broilers, 2.1% of boiling

fowls, 4.9% of ducks, 0% of turkeys and 1.0% of geese contained >0.5 p.p.m. Pb (as did 5.0% of boiling fowl and 1.7% of goose livers), but Cd contents were much higher: in kidneys, 39% of boiling fowls, 69% of turkeys, 72% of ducks and 13% of geese exceeded 0.5 p.p.m., as well as 20% of boiling fowl and 17% of goose livers. If kidneys are discarded and livers separately evaluated, poultry meat is only very slightly contaminated. [See also FSTA (1976) 8 11S1897 and (1977) 9 6S978.] RM

67

Contaminating elements in mineral supplements and their potential toxicity: a review.

Ammerman, C. B.; Miller, S. M.; Fick, K. R.; Hansard, S. L., II

Journal of Animal Science 44 (3) 485-508 (1977) [249 ref. En] [Dep. of Anim. Sci., Univ. of Florida, Gainesville, Florida 32611, USA]

Information to help evaluate the potential injury to animals which may ingest Pb, Cd, Hg, As and V is presented, together with an estimation of the potential risk to consumers of edible animal products. AL

68

[Cadmium in foods of animal origin.]

Jovanovic, J.

Tehnologija Mesa 18 (10) 288-291 (1977) [16 ref. Sh, en] [Dipl. Vet., Belgrade, Yugoslavia]

Cd concn. in meat, liver and kidneys are stated to be within the ranges 0.016-0.183, 0-1.16 and 0.1-40 mg/kg resp. Cd accumulates in tissues of persons consuming Cd-containing meat, the kidneys being the main site of accumulation, followed by the liver, spleen and muscle tissue. Proposed tolerances for Cd in foods of animal origin are briefly discussed. STI

69

A routine screening method for toxic metals in foods.

Allenby, P.; Robertson, J. W.; Shenton, F. C.

Journal of the Association of Public Analysts 15 (2) 61-68 (1977) [17 ref. En] [N.E. Regional Analysts Dep., County Hall, Durham, UK]

A method for the estimation of Pb, Cu, Cd, Zn and As in foods in high and low concn. is described. The sample is partially digested with sulphuric acid and then dry ashed. The ash is dissolved in 3N hydrochloric acid and high levels of Pb, Cu, Cd and Zn are measured in this solution by flame AAS. As is measured in the acid solution by the Gutzeit method. When low levels of Pb, Cu, Cd or Zn are found, the acid solution is extracted with diethylammonium diethyldithio-carbamate in heptan-3-one before aspiration into the instrument. The effects of acidity, shaking time and standing on this extraction system have been investigated. High concn. of Ca and Fe have no important effect on the extraction procedure. A wide variety of foods has been analysed successfully. The s.d. is low. In a

20 g sample, 0.1 p.p.m. Pb, 0.1 p.p.m. Cu, 0.02 p.p.m. Cd and 0.05 p.p.m. Zn can be confidently determined. AS

70

Relative phytotoxicity, uptake, and interactive effects of Cd, Cu, Ni, and Zn to plants [lettuce, wheat] grown on soils amended with metal-enriched sewage sludge. [Thesis; 107pp.]

Mitchell, G. A., Jr.

Dissertation Abstracts International, B 38 (4) 1494: Order No. 77-20329 (1977) [En] [Univ. of California, Riverside, California, USA]

71

The effect of complexing agents on the environmental chemistry and bioavailability of aquatic cadmium.

Lu, C.-L.

Dissertation Abstracts International, B 38 (6) 2601: Order No. 77-26295, 170pp. (1977) [En] [Univ. of Michigan, Ann Arbor, Michigan 48104, USA]

A study was made of the biological uptake of Cd by rice plants, the aim being to assess the main environmental factors which control the availability of Cd to biological systems. The plants were grown in chemically defined growth media under controlled laboratory and field conditions, different forms of Cd being incorporated in the growth media. Several rice types were studied, including those found in the USA and China. Cd uptake by the plants and its distribution in the plants, including polished and unpolished grain, were determined. Cd bioavailability and distribution were found to be dependent on the aqueous chemistry of the growth media and on the type and concn. of the prevailing Cd species. Free Cd was the primary species for uptake under the prescribed experimental conditions. Complexed Cd species required a more complicated mechanism of uptake. Presence of metal-complexing agents in the growth media reduced the bioavailability of aqueous Cd, especially under alkaline conditions; such agents also solubilized particulate and insoluble Cd in the growth media, thus producing increased amounts of Cd in solution and consequently increasing its potential uptake by the plants. JA

72

Zinc and Cd accumulation by corn inbreds grown on sludge amended soil.

Hinesly, T. D.; Alexander, D. E.; Ziegler, E. L.; Barrett, G. L.

Agronomy Journal 70 (3) 425-428 (1978) [10 ref. En] [Dep. of Agron., Univ. of Illinois, Urbana, Illinois 61801, USA]

20 corn inbreds were planted in soil with and without sludge treatment. Liquid sludge was applied in furrows at depths of 6.4, 12.7 and 25.4 mm (max.). At maturity (30% grain moisture) whole ears of corn were collected for grain, dried at 40°C, shelled, redried and ground to pass a 20 mesh

screen. Samples of grain were wet ashed in conc. HNO₃, taken to dryness, dissolved in 1N HNO₃, and Zn and Cd determined by AAS. Concn. of Zn and Cd in the grain of inbreds (except H99 for Zn and H99, C1545 and R805 for Cd) were increased by higher concn. of sludge borne metals in the soil. Concn. of Cd in the grain varied from 0.08 mg/kg for R805 to 3.87 mg/kg for B37. Concn. of Zn in the grain varied from 33.8 mg/kg for H99 to 70.0 mg/kg for A619. SP

73

[Uptake and accumulation of heavy metal salts (Hg, Cd) from feed by rainbow trout.] Über Aufnahme und Anreicherung von Schwermetallsalzen (Hg, Cd) aus Futtermitteln in Regenbogenforellen.

Jacobs, G.

Zeitschrift für Tierphysiologie, Tierernährung und Futtermittelkunde 40 (5) 274-284 (1978) [21 ref. De, en] [Inst. für Biochem., Martin-Luther-King-Platz 6, D-2000 Hamburg 13, Federal Republic of Germany]

Young rainbow trout (*Salmo gairdneri*) were used in a study on effects of the Cd or Hg content of the diet on accumulation of these elements in fish tissues. Tables of results are given. Feeding a diet with 7 p.p.m. Hg as methylmercury for 8 days increased muscle Hg concn. to 1.04 p.p.m. (vs. 0.1 p.p.m. for control samples). Feeding a diet with 1.02 p.p.m. Hg as methylmercury for 2 months increased Hg concn. in the muscle, liver and kidney to 0.67, 1.06 and 1.38 p.p.m. resp. (vs. initial values of 0.05, 0.08 and 0.10 p.p.m.). Feeding a diet with 9.8 p.p.m. Hg as HgCl₂ for 86 days gave only slight increase in tissue Hg concn. Feeding a diet with 1.72 p.p.m. Cd (as CdCl₂) for 2 months gave no significant increase in Cd concn. in muscle, liver or kidney tissue. Feeding 16 p.p.m. Cd (as CdCl₂) for 22 days gave no significant increase in the Cd content of muscle tissue, but increased Cd concn. in the liver and kidneys to 0.57 and 0.56 resp. (vs. 0.04 and 0.14 resp. for control samples). Diets containing 1.08 p.p.m. Cd as cadmium acetate, fed for 2 months, had little effect on Cd concn. in the muscle, kidney or liver. AJDW

74

Mineral concentrations in animal tissues: certain aspects of FDA's regulatory role.

Mahaffey, K. R.

Journal of Animal Science 44 (3) 509-515 (1977) [19 ref. En] [Div. of Nutr., Bureau of Foods, FDA, Washington, DC 20204, USA]

Current FDA regulatory programmes in toxic metals (Hg, Pb, Cd, Zn, As and Se) and detn. of max. tolerable levels in foods are discussed, as well as the regulation of metals intended as nutritional or veterinary feed supplements for animals in relation to the resultant metal content of edible animal tissues and products. AL

75

[The effect of cadmium concentration in the feed on its accumulation in edible tissues.] Die

Ansammlung von Cadmium in verzehrbaren Geweben in Abhängigkeit von der Cadmium-Menge im Futter.

Hapke, H.-J.; Abel, J.; Kühl, U.; Glaser, U.

Archiv für Lebensmittelhygiene 28 (5) 174-177

(1977) [15 ref. De, en] [Tierärztliche Hochschule, Bischofsholer Damm 15, 3000 Hannover, Federal Republic of Germany]

Daily levels of 0.1-12.5 mg Cd/kg body wt. were supplied to sheep for 4½ and 12 months before slaughtering, and Cd concn. in blood, muscle, fat, liver and kidneys (cortex and medulla) were determined. Results, shown graphically and in tables, revealed that 6 p.p.m. Cd daily doses produced accumulation of 0.6 and 10 p.p.m. in liver and kidney resp. and <0.1 p.p.m. in muscle after 12 months. Max. concn. was reached in muscle and liver at 4½ months. Cd accumulation in muscle was found only after supplying ≥30 p.p.m. in the feed (0.5 mg/kg body wt.). This concn. also affected the health of the animals. The study suggests that Cd concn. in the feed must be kept <0.5 p.p.m. RM

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FAB 37

CADMIUM IN FOODS

SELECTED FROM VOLUME 11

FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

under the direction of

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H. BROOKES

EDITOR

1

[The 13th meeting of the Northern Section of the German Chemists Association, held in Oldenburg on 9 March 1978.] 13. Sitzung des Arbeitskreises Nord am 9. März 1978 in Oldenburg. [Conference proceedings] Germany, Federal Republic of, Gesellschaft Deutscher Chemiker Arbeitskreis Nord *Lebensmittelchemie und Gerichtliche Chemie* 32 (4) 81-87 (1978) [De]

Summaries are given of papers presented at this meeting, including the following: Separation of the colorants E110 and E111 by high pressure liquid chromatography, by W. Frede (p. 83); Laboratory automation. Possibilities of data processing, by J. Smetenat (p. 84); and Problems of determination of Hg, Pb and Cd in fish, by R. Kruse (p. 86). 8 further papers are abstracted separately in FSTA, and are listed in the author index under Germany, Federal Republic of, Gesellschaft Deutscher Chemiker Arbeitskreis Nord [13th Symposium]. AJDW

2

Food surveillance in the UK.

Hubbard, A. W.

Nutrition Reviews 36 (7) 224-230 (1978) [10 ref. En] [Min. of Agric., Fisheries & Food, Great Westminster House, Horseferry Road, London SW1P 2AE, UK]

Monitoring of heavy metal content of foods in the UK is reviewed with particular reference to Pb and Cd. Tabulated data show mean levels and ranges of Pb and Cd contents found during recent surveys in cereals, meat and fish, fats, fruit, vegetables and milk. Pb contents in brassicae and root crops produced near a metal refining plant are tabulated and sources of Pb and Cd contamination of foods are discussed. DIH

3

[Simple and efficient methods for determination of biocides in foods.] Einfache und leistungsfähige Methoden zur Bestimmung von Bioziden in Lebensmitteln. [Lecture] Lohse, H.

Lebensmittelchemie und Gerichtliche Chemie 32 (4) 84-85 (1978) [3 ref. De] [Staatliche Chem. Untersuchungsanstalt, 2800 Bremen, Federal Republic of Germany]

A modification of Sperling's AAS method for detn. of heavy metals is described; a 10 mg homogenized sample of the material under test is wet-ashed at 90° C using 50 µl of a 1:4 mixture of HNO₃ and HClO₄; after dilution to 1000 µl, the heavy metals are determined by AAS (analytical conditions given). Tables of data are given for heavy metal concn. in samples of kale and mushrooms. Kale contained 2.0-34.4 mg Pb/kg and 0.16-0.80 mg Cd/kg; mushrooms contained 0.47-2.40 mg Pb/kg and 0.63-9.30 mg Cd/kg. The potential of gel permeation chromatography as a technique for preparation of samples for subsequent detn. of pesticides and plasticizers by high pressure liquid chromatography is discussed. [See FSTA (1979) 11 2A59.] AJDW

4

[Aspects of medical interest concerning mushrooms.] [Lecture]

Vigne, J.; Gounelle de Pontanel, H.

Medecine et Nutrition 14 (2) 131-135 (1978) [22 ref. Fr] [Cent. de Recherches Foch, 4 Rue de l'Observatoire, 75006 Paris, France]

Aspects considered include: the capacity of fungi to accumulate heavy metals from their substrate, with consequent relatively high heavy metal concn. in the edible parts; bacterial contamination; the risk of botulism from canned or bottled mushrooms; and the potential for growth of *Clostridium botulinum* in fresh mushrooms in gas-tight plastics packs. [See FSTA (1979) 11 2]266.] AJDW

5

Determination of lead and cadmium in pasteurized liquid milk by flameless atomic absorption spectrophotometry.

Koops, J.; Westerbeek, D.

Netherlands Milk and Dairy Journal 32 (2) 149-169 (1978) [146 ref. En, nl] [Netherlands Inst. for Dairy Res. (NIZO), Ede, Netherlands]

Small samples [approx. 2.4 ml] of milk are freeze-dried in specially designed teflon tubes and digested in the same tubes with HNO₃ for 3 h at 150° C after enclosure in stainless steel bombs. The digests are diluted with double distilled water and the Pb and Cd contents determined by the method of standard additions. A direct approach for Pb in diluted milk, omitting the preceding digestion step, is possible. Average values found for Pb and Cd in 12 samples of pasteurized milk, derived from various parts of the country, are 5 and 0.4 µg/kg resp. AS

6

[Mercury, zinc, copper, lead and cadmium in herrings.]

Vanderstappen, R.; Clerck, R. de; Vyncke, W.; Moermans, R.

Revue de l'Agriculture 31 (2) 331-336 (1978) [17 ref. Fr] [Inst. de Recherches chimiques, Museumlaan 51, B-1980 Terouren, Belgium]

The following results were obtained from metal detn. in herrings fished from the south part of the North Sea and the east part of the English Channel (mg/kg): Hg 0.04; Zn 6.6; Cu 0.48; and Pb 0.31; 72% of Cd detn. were below the limit of detection (0.01 mg/kg), and of the rest 0.01 mg/kg was found in 6 herrings, 0.02 in 4, 0.03 in 3, and 0.04 mg/kg in 1. Only Pb contents were significantly higher in fish from the Channel than from the North Sea (0.34 vs. 0.28 mg/kg). There was no significant correlation between wt. of the fish and heavy metals contents (except for negative correlation with Zn, $r = -0.487$), and none between the different metals. RM

7

[Simplified digestion method and determination of lead, cadmium and arsenic in animal tissues by atomic absorption spectrometry.] Vereinfachte Aufschlussmethode und Messtechnik zur Bestimmung von Blei, Cadmium und Arsen in tierischen Geweben

mittels Atomabsorptionsspektrometrie.

Holm, J.

Fleischwirtschaft 58 (5) 864-866; 745 (1978) [17 ref. De, en] [Staatliches Veterinäruntersuchungsamt, Dresdenstrasse 6, 3300 Braunschweig, Federal Republic of Germany]

The previously developed method [FSTA (1976) 8 11S1897] is described with a view to its use for quick and accurate residue detn. for official meat examination. Pb, Cd and As concn. were determined in muscle, liver and kidney by wet digestion and AAS, and the method critically examined. Limits of detection for the 3 metals were 0.5-1.0 parts/billion; recovery rates were 87-107% for Pb (0.25-2.0 ng additions) in all tissues, 84-106% for Cd (0.05-0.4 ng) in all tissues, 82-92% for As (12.5-100.0 ng) in muscle and liver, and 75% for As in kidney. The low As recovery in kidney could be due to a matrix effect of the As-hydride system. Reproducibility was satisfactory. Optimum loading of the instrument and the quick digestion method allowed results to be obtained within 24 h. A disadvantage of the method is that it does not include Hg detn. RM

8

[Lead, cadmium, copper and zinc contamination in and on spices.] Schwermetallkontamination von Blei, Cadmium, Kupfer und Zink in und auf Gewürzen.

Gerhardt, U.; Muhr, G.

Fleischwirtschaft 58 (5) 857-860, 863; 739 (1978) [21 ref. De, en] [Firma Gewürzmüller Karl Müller & Co., Postfach 30 04 80, 7000 Stuttgart 30, Federal Republic of Germany]

Inverse voltametry was used to determine the Pb, Cd, Cu and Zn contents of whole commercial spices and additives, their reduction after washing and increase during grinding (secondary contamination). Results were tabulated and compared with published values. The main advantage of inverse voltametry is its use of acetate buffer as basic electrolyte, allowing the simultaneous detn. of 4 elements from a digestion solution. Dry ashing causes losses, especially of Pb and Cd. The % s.d. for reproducibility of peak height was 3.1 for Pb, 14.6 for Cd, 7.2 for Zn and 1.5 for Cu. The amounts found were small and quantities absorbed from seasoned foods can be ignored (max. contents 0.70 p.p.m. Cd in black pepper, 4.10 p.p.m. Pb, 51.2 p.p.m. Zn and 16.7 p.p.m. Cu in paprika; 6.16 p.p.m. Pb in ground bay leaves, 1.36 p.p.m. Cd and 50.6 p.p.m. Zn in chopped parsley, 26.2 p.p.m. Cu in basil). Only 1 sample of ground bay leaves exceeded the 5 p.p.m. tolerance level. The Pb and Zn contents were greatly reduced by rinsing in water, but Cd and Cu concn. were scarcely affected. No secondary contamination was observed after mechanical grinding. RM

9

[Trace elements in spices. I. The toxic elements lead, cadmium and mercury.] Spurenelemente in Gewürzen. I. Die toxischen Elemente Blei, Cadmium und Quecksilber.

Hecht, H.

Fleischwirtschaft 58 (5) 849-854; 745 (1978) [9 ref. De, en] [Bundesanstalt für Fleischforschung, 8650 Kulmbach, Federal Republic of Germany]

200 commercial samples of 36 herbs and spices were analysed for Pb, Cd and Hg by flameless ASS after wet digestion in a closed system. Results, shown in tables and histograms, showed great variations in concn. Generally the Cd and Pb concn. were much higher than those of meat and meat products, but possible health hazards must be judged in the light of the small amounts used. The leaf products were more heavily contaminated than fruit, flower, seed and rhizome products, e.g. marjoram contained max. concn. of 41.0 parts/billion (p.p.b.) Cd, 3.16 p.p.m. Pb, and 593 p.p.b. Hg and thyme contained 42.4 p.p.b. Cd, and 2.26 p.p.m. Pb. Other high Pb concn. were found in aniseed (2.91 p.p.m.) and paprika (1.08 p.p.m.). The mean concn. of Cd (p.p.b.), Pb (p.p.m.) and Hg (p.p.b.) for each group were: fruits, 18.2, 0.339, 39.4; flowers and seeds, 28.9, 0.193, 20.6; leaves, 30.4, 0.708, 98.2; and rhizomes, 10.1, 0.228, <0.536. The generally high contamination of marjoram may be important as this herb is added in appreciable amounts to some meat products. The available material did not provide clear evidence of secondary contamination during grinding, though some increase in Cd and Pb concn. was observed in pepper, nutmeg, pimento and cloves, and (possibly accidental) decrease in Pb concn. in cinnamon. Decorticating pepper did not significantly reduce contamination. RM

10

Trace metals in food.

Reilly, C.

Food Manufacture 52 (1) 60-62, 77 (1977) [3 ref. En] [Dep. of Food Sci., Oxford Polytech., Oxford, UK]

The 3 major dangerous metal contaminants of foods, Hg, Cd and Pb, are discussed in terms of environmental sources and methods of excluding them from processed foods. Hg contamination can be avoided by proper control of raw materials and avoidance of gross metal contamination during production. Cd may be concentrated biologically, or may enter food from rust-proof platings, especially galvanized surfaces, as commercial zinc contains $\leq 1\%$ Cd. Pb is more abundant than Hg or Cd, and is accumulated in the body, thus making minimization of Pb contents in all parts of the diet a priority. Pb may enter food from solder on can seams and on repaired equipment, from enamels and glazes on pottery, from leaden pipework and tanks, and from paper and foil not designed for, but used for, wrapping food. Lead in Food Regulations restrict the level of Pb in most foods to ≤ 2 mg/kg, but ≤ 0.5 mg/kg in baby foods. Hg and Cd are not statutorily controlled; the WHO recommendations are 0.3 mg Hg and 0.4-0.5 mg Cd/wk. These levels are much greater than actual intakes in the UK. Other toxic metals, such as Zn and Cu, are also discussed briefly, and the problems of statutory limitations on trace elements are mentioned. JRR

11

[Heavy metals in packaging materials for foods. Are coloured plastics packs necessary?]

Andersson, E.; Engquist, A.; Frank, A.

Svensk Veterinartidning 29 (21) 833-836 (1977) [8 ref. Sv, en] [Statens Vet. Med. Anstalt 104 05 Stockholm, Sweden]

Various plastics packaging materials were analysed for Pb and Cd by AAS. A red plastics lid of a marmalade jar contained 45 mg Cd; a yellow lid of a mustard jar contained 11.4 mg Cd. Cd and Pb were also detected in coloured plastics drinking straws, ketchup bottles, etc. Appreciable quantities of Pb and Cd were also detected on the exterior of printed plastics beakers, bags, and vacuum packs; however, little or no contamination of the packaged food was observed. Coloured plastics carrier bags had high Pb contents. Heavy metal content did not appear to be related to colour intensity. These results are discussed in relation to the potential health hazard from contact of foods with heavy metal-containing packaging materials, and contamination of the environment during disposal of such materials; it is suggested that use of heavy metal-containing pigments is unnecessary. AJDW

12

The trace metal content of a representative Canadian diet in 1972.

Kirkpatrick, D. C.; Coffin, D. E.

Canadian Journal of Public Health 68 (2) 162-164 (1977) [6 ref. En, fr] [Food Res. Lab., Health Protection Branch, Dep. of Nat. Health & Welfare, Ottawa, Ontario, Canada K1A 0L2]

Results are presented for the levels of Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni and Zn in a representative Canadian diet for 1972. The distribution of each of these trace metals between 12 food groups within the diet is presented and discussed in relation to their relative contribution and possible areas of accumulation. The average daily intakes of these trace metals in the diet are calculated. AS

13

Cadmium deposition and hepatic microsomal induction in mice fed lettuce grown on municipal sludge-amended soil.

Chaney, R. L.; Stoewsand, G. S.; Bache, C. A.; Lisk, D. J. *Journal of Agricultural and Food Chemistry* 26 (4) 992-994 (1978) [25 ref. En] [USDA, Beltsville, Maryland 20705, USA]

'Paris White' romaine lettuce (*Lactuca sativa*) was grown on soil amended with various types of sewage sludges as follows: (i) control, soil alone, (ii) anaerobically digested Baltimore sludge, (iii) anaerobically digested Blue Plains sludge from Washington DC, (iv) (iii) composted with wood chips and windrowed, (v) Milorganite, commercial dried secondary sludge and (vi) heat-dried Blue Plains raw sludge + 50% (v). Application rates to soil for (ii)-(vi) were 56, 112, 224, 56 and 56 t/ha, resp. Contents of Cd and Zn in the sludges are tabulated. Cd and Zn contents (p.p.m., dry wt.) in lettuce leaves were (i) 0.6 and 47, (ii) 1.7 and 419, (iii) 2.5 and 307, (iv) 1.1 and 75, (v) 26.4 and 187, and (vi) 11.6 and 209, resp. Levels of Cd and Zn in lettuce correlated with those in sludge. Lettuce leaves were fed to mice for 6 wk as 45% dry wt. of a complete diet. Cd levels in liver and kidney were increased 4 and 6 ×, resp. for (v) vs. control-fed mice. Levels of mouse liver microsome p-nitroaniline O-demethylase were significantly higher than controls for mice fed lettuce from (v). DIH

14

[The determination of microamounts of heavy metals in vegetable oils by differential pulse polarography.]

Shinozuka, N.; Hayano, S.

Journal of Japan Oil Chemists' Society [Yukagaku] 27 (5) 312-313 (1978) [6 ref. Ja, en] [Inst. of Ind. Sci., Univ. of Tokyo, Japan]

Pb and Cd in vegetable oils were determined by differential pulse polarography. The oils were dissolved in 1:1 (v/v) ethanol/benzene mixture containing 0.01-m LiCl. Peak currents of the metals added at p.p.m. levels were proportional to their concn. (≤ 20 p.p.m.) and were not affected by the nature of the anion. The method is fast and simple, but in some cases it may be necessary to destroy interfering peroxides. RM

15

Trace metal content of a herring oil at various stages of pilot-plant refining and partial hydrogenation.

Elson, C. M.; Ackman, R. G.

Journal of the American Oil Chemists' Society 55 (8) 616-618 (1978) [18 ref. En] [Dep. of Chem., Saint Mary's Univ., Halifax, Nova Scotia, B3H 3C3, Canada]

Samples of a typical Atlantic herring oil at various stages of pilot-plant processing were analysed for Cd, Se, As, Hg, Cu, Pb and Zn. The Hg content of the crude oil was relatively low and was not greatly affected by processing. The Se level of 47 parts/billion in the crude oil was significantly lowered by hydrogenation and deodorization. As was removed by alkali refining. The Pb content was reduced by only 40% upon refining, probably because Pb was present as an organometallic material. The concn. of the other heavy elements was generally lowered during processing. AS

16

[Animal experiments on the carry-over of toxic trace elements from feedingstuff into milk.]

Tierexperimentelle Untersuchungen zum Carry-over toxischer Spurenstoffe aus Futtermitteln in die Milch. Blüthgen, A.; Heeschen, W.; Kaiser, M.; Hamann, J.; Tolle, A.

Kieler Milchwirtschaftliche Forschungsberichte 30 (2) 139-155 (1978) [32 ref. De, en, fr] [Inst. für Hygiene, Bundesanstalt für Milchforschung, Kiel, Federal Republic of Germany]

Max. intakes of Pb, Cd and Hg by dairy cattle consistent with maintaining levels in the milk below the tolerated limits (0.05, 0.01 and 0.02 mg/kg milk, resp.) proposed by WHO were investigated. The likelihood of these limits being exceeded in normal farm practice was examined. Pb and Cd were determined by atomic absorption spectrophotometry, and Hg by GLC. In 20-day experiments no dangerous carry-over of these toxic metals into the milk was found to follow feeding of Pb, Cd and Hg in amounts up to 100, 100 and 10 mg/kg fodder TS, resp. The Pb and Cd contents of typical farm-type rations fed averaged 2.67 and 0.168 mg/kg TS (in single cases > 20.0 and > 1.0), resp. Risks of the toxic metal content of milk exceeding WHO recommended limits under normal farming conditions are thus extremely slight. GTP

17

[Occurrence of zinc and cadmium in salt- and freshwater fish.]

Nabrzyński, M.; Gajewska, R.

Bromatologia i Chemia Toksykologiczna 11 (3) 259-264 (1978) [Pl, en, ru] [Zakład Bromatologii Akad. Med., Gdansk, Poland]

A total of 163 samples of 14 spp. of (i) freshwater fish (2-47 samples of each) and 60 samples of 8 spp. of (ii) saltwater fish (2-22 of each), from Polish waters, were wet ashed with conc. $\text{H}_2\text{SO}_4 + \text{HNO}_3 + \text{HClO}_4$, and their contents of Zn and Cd were determined spectrophotometrically as dithizone complexes. In (i), mean Zn concn. ($\mu\text{g}/100 \text{ g}$) ranged from 541 to 2235 (range, 42-3492) and mean Cd concn. from 0.5 to 14.0 (range, 0-20.1); in (ii), corresponding concn. were Zn, 555 to 1218 (range, 169-1500), and Cd, 2.2 to 22.9 (range, 0.5-26.4). The Zn:Cd ratio was always 170:1. The spawn had a 3-4 \times higher content of Zn than the flesh for both types of fish; with regard to Cd, there was no difference between the spawn and flesh in freshwater fish samples, but the spawn Cd content was twice that of the flesh in the seawater fish. HBr

18

[Heavy metal toxicity. A literature review.] [Review] Korkeala, H.; Mannonen, J.

Suomen Eläinlääkärilehti 84 (1) 13-15, 18-25 (1978) [72 ref. Fi, en, sv] [Eläinlääketieteellinen Korkeakoulu, Elintarvikehygienian Laitos ja Anatomian ja Embryologian Laitos, 00550 Helsinki 55, Finland]

The metals covered in this review are Hg, Pb and Cd. The digestive tract is the most common route of access to the organism, with the liver and kidneys forming the main targets. HBr

19

[Vegetable oils and fats. Preparation of samples for determination of metals.]

Romania, Institutul Roman de Standardizare
Romanian Standard STAS 145/23-77, 2pp. (1977) [Ro] [Strada Roma 32-34, Bucharest, Romania]

A procedure is described for extraction of metals from vegetable oils by heating an emulsion of 100 g oil with 15 cm³ HCl (a 3:2 aqueous dilution of HCl of sp. gr. 1.18-1.19) on a boiling water bath until the emulsion clears, and separation and filtration of the lower (aqueous) phase. The extraction is then repeated. The aqueous solution may then be used for detn. of Cu, Pb, Zn or Cd. [See also following abstr.] AJDW

20

Studies on toxic trace metals in the environment by advanced polarographic methods. [Review] Nürnberg, H. W.

Proceedings of the Analytical Division of the Chemical Society 15 (10) 275-283 (1978) [30 ref. En] [Inst. of Chem., Nuclear Res. Cent., Jülich, Federal Republic of Germany]

This review discusses general environmental and toxicological aspects of toxic trace metals with special reference to food chains, methodological aspects and applications. The highest sensitivity of detn. is achieved by differential pulse anodic stripping voltammetry at a

mercury-film electrode, $1 \times 10^{-11} \text{ mol Cd/l.} \leq 5 \text{ trace metals}$ can be determined simultaneously by voltammetry, at lower speed but much more reliably than by AAS. In addition, voltammetry is sensitive to the dissolved chemical species and not only the elemental nature of trace metals. Important applications include drinking water and natural waters. RM

21

[Microdetermination of lead, cadmium, zinc and tin in biological materials by AAS after mineralization and extraction.]

Boiteau, H. L.; Metayer, C.

Analysis 6 (8) 350-358 (1978) [11 ref. Fr, en] [Lab. de Toxicol. et d'Hygiène Ind., 1 Rue Gaston-Veil, F-44035 Nantes Cedex, France]

After showing that separation of the elements improves detn. by flameless AAS, the authors describe 2 techniques for detn. of either Pb, Cd and Zn or Sn in any biological medium (blood, wine, food products of animal or vegetable origin). All the operations (mineralization and extraction) are performed in the same tube. The techniques are designed so as to reduce the risk of contamination and to allow detn. in series. Using 250 mg samples, limits of detection are 2 parts/billion for Cd, 40 parts/billion for Pb and Sn, 2 p.p.m. for Zn. The coeff. of reproducibility was $< \pm 10\%$. Mineralization and extraction had little effect on the accuracy of the results. RM

22

[Determination of cadmium in products made from plastics materials]

Lewandowska, I.

Roczniki Państwowego Zakładu Higieny 29 (3) 295-298 (1978) [8 ref. Pl, en, ru] [Zakład Badania Żywności i Przedmiotów Użytku Państwowego Zakładu Higieny, Warsaw, Poland]

5 different food model solutions (distilled water, 3% acetic acid, 10% ethanol, ethyl ether and 4% acetic acid) were used to study migration of Cd from polypropylene and low-impact polystyrene (each stained with 0.1 and 1.0% Cd red) and polyamide 6 (0.5% Cd red); extraction conditions were 5 h at b.p. except for the 4% acetic acid solution (24 h at 20° C); AAS was used for detn. of the migration. The greatest degree of Cd migration was observed from the polyamide 6 (nylon) in 3% and 4% acetic acid; no migration from any of the plastics was observed with ethyl ether. The results are interpreted as confirming the need to ban Cd pigments in plastics materials which could come into contact with foods. HBr

23

Contributions to automated trace analysis. IV. Device for the automated simultaneous on-line determination of toxic trace metals in drinking water.

Valenta, P.; Rützel, M.; Krumpfen, P.; Salgert, K. H.; Klahre, P.

Zeitschrift für Analytische Chemie 292 (2) 120-125 (1978) [16 ref. En, de] [Inst. of Chem., Nuclear Res. Cent. (KFA) PO Box 1913, Jülich, Federal Republic of Germany]

A reliable and robust automated device for simultaneous voltammetric analysis (by differential pulse anodic stripping voltammetry) of several of the most toxic trace metals (Cu, Pb, Cd, Zn) in drinking and ground water is described. It allows the required around-the-clock monitoring of drinking water in waterworks over long periods (several wk) with supervision. The device consists of adapted commercial polarographic instrumentation, a punched card programme controller and automatic sampling and standard addition facilities. Extended tests under realistic routine practical working conditions over several months established the suitability and potential of the concept and the satisfactory performance of the device. [See also *Zeitschrift für Analytische Chemie* (1976) 282, 369; and (1977) 285, 25.] AS

24

Variability in the concentration of 12 elements in corn grain.

Pietz, R. I.; Peterson, J. R.; Lue-Hing, C.; Welch, L. F. *Journal of Environmental Quality* 7 (1) 106-110 (1978) [36 ref. En] [Res. & Dev. Lab., Canton, Illinois 60611, USA]

Corn grain (*Zea mays* L.) samples were collected from 9 University of Illinois Agronomy Research Fields situated throughout Illinois and from 6 soil associations in Fulton County. The 243 samples were obtained from sites receiving only inorganic fertilizers. The objective was to determine levels of selected elements in corn grain as it is commonly grown in Illinois. Chemical analysis of the corn grain for Ca, Fe, K, Mg, Mn, Na, Cd, Cr, Cu, Ni, Pb and Zn showed that concn. of K and Mg were highest, while levels of Cd, Cr and Pb were <0.2 µg/g. Variability of Na, Cd and Cr in the grain samples was high, while that of Mg, Zn and Mn was low. Element concn. in grain were within the ranges given in the literature. Concn. of Ca, Mg, Mn, K, Na, Cd, Cu, Cr, Ni, Pb and Zn from the 9 research fields varied significantly with location. Soil type at the 6 soil associations significantly affected the concn. of Mg, Mn, K, Cd and Cr in the grain. There was a highly significant positive correlation for applied fertilizer N and the grain Mn content for samples from the research fields. Highly significant negative correlations were observed for applied fertilizer N and the K, Na, Cd and Pb levels in corn grain. An evaluation of possible health effects for selected corn grain metals indicated that the background levels of Cd, Cr, Cu, Pb and Zn observed would not present any human or animal health problems. AS

25

[Contamination by lead and cadmium during smoke drying of cereals.] Untersuchungen zur Blei- und Cadmiumkontamination bei der Rauchgastrocknung von Getreide.

Woggon, H.; Malkus, Z. *Nahrung* 22 (7) 647-654 (1978) [6 ref. De, en, ru] [Zentralinst für Ernährung, Potsdam-Rehbrücke, German Democratic Republic]

Studies were conducted on effects of direct drying of oats, rye and wheat with combustion gases (using diesel oil as the fuel) on the Cd and Pb contents of the grain.

11 cereal samples were studied. Pb and Cd concn. were determined by direct inverse polarography, indirect inverse polarography (after dithizone extraction) or AAS; recovery data are given, and the relative merits of the analytical techniques are considered. Block diagrams are given showing Cd and Pb concn. before drying and after drying once or twice. The results show that direct drying using combustion gases generally had little effect on Cd or Hg concn. in grain. Cd concn. in all samples was well below the tolerance limit (0.10 mg/kg in the DM). 2 samples exceeded the tolerance limit for Pb (0.5 mg/kg in the DM); however, these samples had high Pb concn. before drying. It is concluded that this drying method gives little danger of contamination with heavy metals; however, there may be a risk of contamination with carcinogenic hydrocarbons. IN

26

An improved ashing procedure for the determination of heavy metals in edible oils.

Tsai, W.-C.; Lin, C.-P.; Shiao, L.-J.; Pan, S.-D. *Journal of the American Oil Chemists' Society* 55 (10) 695-698 (1978) [11 ref. En] [Food Ind. Res. & Development Inst., PO Box 246, Hsinchu, Taiwan, China]

An accurate, reliable, and simple method is described for the detn. of Pb, Cu, Cd, Mn, Zn, and Fe in edible oils by AAS following burning of the sample in a restricted air supply. Recoveries for the 6 heavy metals by the proposed methods were about 100%. The relative s.d. of the analysis for Pb at the level of 0.074 p.p.m. was 6%, and the Cu at the levels of 0.064 p.p.m. and 0.158 p.p.m. were 7% and 2%, resp. The recovery of Pb was found to be suppressed by the presence of a large quantity of Fe in the oil, but the suppression was alleviated by adding a $Mg(NO_3)_2$ solution to the charred residue before ashing. AS

27

Heavy metals in tissues of stranded short-finned pilot whales.

Stoneburner, D. L. *Science of the Total Environment* 9 (3) 293-297 (1978) [20 ref. En] [Nat. Park Service, 1895 Phoenix Boulevard, Atlanta, Georgia 30349, USA]

Liver and blubber tissue from 4 stranded short-finned pilot whales (*Globicephala macrorhynchus*) were analysed for total Hg, Cd and Se by neutron activation. Results of analysis (on wet wt. basis) showed that ranges were (p.p.m.): Hg 0.22-2.37, Se 0.77-1.35, and Cd 0.34-0.75 in blubber; and Hg 56.9-454, Se 22.80-61.60, and Cd 11.30-19.80 in liver tissue. A comparison of healthy whales of the same sp. showed that metal concn. were 3-4 times greater in the stranded whales. SP

28

Accumulation and distribution of trace metals and radionuclides in marine organisms (particularly *Tapes decussatus* L.) in the Izmir Bay area, Turkey. (In 'Trace contaminants of agriculture, fisheries and food in developing countries' [see FSTA (1979) 11 3C142]) [Lecture]

Geldiay, R.; Uysal, H.

pp. 81-85 (1976) [9 ref. En] [Ege Univ. Sci. Fac., Dep. of General Zoology & Marine Biol. Lab., Bornova-Izmir, Turkey]

The concn. of trace metals, Cu, Mn, Fe, Zn, Pb, Co, Cr, Hg, Cd, in the shellfish *Tapes decussatus* from polluted and non-polluted waters were studied. Results of analysis of concn. of heavy metals in *T. decussatus* (in non-polluted areas only) showed the following concn. ($\mu\text{g/g}$ dry wt. basis), for muscle and soft body resp.: Cu, 1.74 and 9.82; Mn, 5.92 and 3.40; Zn, 59.18 and 94.17; Fe, 79.89 and 198.95; Cd, 4.19 and 5.98; Co, 4.61 and 6.19; Cr, 2.79 and 3.63; Pb, 10.62 and 2.65; and Hg, 3.04 and 2.47. Laboratory experiments with *T. decussatus* using ^{65}Zn and ^{115}Cd as tracers showed that accumulation and distribution in organs was similar to that found in samples from natural environmental conditions. SP

29

[Determination of copper, cadmium and zinc in bone by atomic absorption spectrophotometry.]

Ishino, F.; Matsumae, H.; Shibata, K.-I.; Ariga, N.; Goshima, F.

Japan Analyst [Bunseki Kagaku] 27 (4) 232-236 (1978) [9 ref. Ja, en] [Gifu Univ., Shironouchi, Nagara, Gifu-shi, Japan]

The detn. of trace metals in bone by drying and ashing was studied. Pork bone was defatted with diethyl ether, dried at 110°C under reduced pressure, dissolved in HNO_3 , evaporated with addition of a few drops of H_2O_2 , ashed at $350-400^\circ\text{C}$, adjusted to pH 2-3, trace metals extracted with methyl isobutyl ketone (MIBK) in the presence of ammonium pyrrolidine dithiocarbamate, and the MIBK layer analysed by AAS. 6 replicate detn. by the standard addition method gave coeff. of variation of 5.3, 4.9 and 7.0% resp. for Cu (1.10 $\mu\text{g/g}$), Cd (0.46 $\mu\text{g/g}$) and Zn (344 $\mu\text{g/g}$). RM

30

[Standards (1976) for levels of arsenic, lead, cadmium and mercury in foods.] Richtwerte '76 über Arsen-, Blei-, Cadmium- und Quecksilbergehalte in Lebensmitteln.

Anon.

Bundesgesundheitsblatt 20 (5) 76 (1977) [De]

A table is given of standard max. levels of heavy metals in several foods, expressed as mg/kg fresh wt. Food groups covered include beef, pork and poultry meats, milk and milk products, vegetables, fruit, cereals, sugar, beer and vegetable oils. JRR

31

Mineral intakes of university students: cadmium and manganese content.

Srivastava, U. S.; Nadeau, M. H.; Carbonneau, N.

Nutrition Reports International 18 (3) 325-336 (1978) [17 ref. En] [Dep. of Nutr., Univ. of Montreal, Montreal, Quebec, Canada]

The amount of Cd and Mn in 3 main meals, selected by students in a university cafeteria were analysed over a period of 3 wk. The average Cd and Mn contents of meals selected by the students were 73.15 μg and 3.03 mg, resp. The mean daily intake of Cd in this study was in agreement with that found in a composite

Canadian diet. However, the average Mn content was lower than that of the composite Canadian diet, but was in close agreement with that observed in the USA. The Cd and Mn available to students was highly concentrated in only 2 meals: Cd, lunch (26.4 μg) and dinner (32.0 μg); Mn, lunch (1.04 mg) and dinner (1.37 mg). Meals selected by female students contained lower amounts of Cd, 66.5 μg and Mn, 2.60 mg than those selected by male students, 79.8 μg and 3.50 mg, resp. There were large variations in the Cd and Mn concn. of the various types of meals when they were classified according to their main dish component, which included salad platter, veal cutlet, ham sandwich platter, white and red meat, lasagne, cold cuts, blood sausages and fruit platter. AS

32

[Studies on the Cd content of prepared foods for infants and young children.] Untersuchungen über den Cadmiumgehalt in Säuglings- und Kleinkinderfertiernahrung.

Schulte-Löbbert, F.-J.; Bohn, G.; Acker, L.

Lebensmittelchemie und Gerichtliche Chemie 32 (5) 93-96 (1978) [12 ref. De] [Inst. für Gerichtliche Med., Westfälische Wilhelms-Univ., 4400 Münster, Federal Republic of Germany]

Cd was determined by AAS in samples of a wide range of prepared foods for infants and young children, including products based on cereals, milk, meat, fruit, and fruit juices. Tables of results are given. Mean values (with max. values in parentheses) for various types of product were (parts/billion): milk products 7.8 (13.0); fruit juices 26.2 (67.5); fruit products 20.5 (64.6); prepared meals 29.8 (67.7); and milk/cereal products 16.0 (35.0). Average daily Cd intake is calculated to be 0.04 mg for the 1st month of life, 0.12 mg at 8-12 months of age. AJDW

33

Environmental impact of cadmium.

Varma, M. M.; Katz, H. M.

Journal of Environmental Health 40 (6) 308-314 (1978) [42 ref. En]

Cd pollution in the environment, including drinking water and food, is discussed. Investigation of 969 drinking water supplies in 1969 by the US Public Health Service showed a median Cd concn. of 1.4 parts/billion. Evaluation in 1973 by the FDA of Cd in food showed that in a typical 'market basket' representing the recommended 2 wk diet of a 15-20 yr old male, 22.8% of total dietary Cd was from grain and cereal, 18.3% from fruits, 17.8% from potatoes and 12.7% from beverages, and that 71.7-89.7% of the provisional tolerable weekly intake of Cd (400-500 μg) could be obtained from this basket. Health effects of Cd are also discussed. SP

34

[Determination of Pb and Cd in mineral waters by anodic stripping voltammetry.]

Costantini, S.; Pepe, A.; Giordano, R.

Rivista della Societa Italiana di Scienza dell'Alimentazione 7 (3) 225-230 (1978) [6 ref. It] [Istituto Superiore di Sanita, Rome, Italy]

Pb and Cd were determined in 56 samples of mineral water (54 from Italy, 2 from France) by anodic stripping voltammetry using an ESA model 3010 automatic voltammeter. Operating conditions, electrode standardization, etc. are discussed. A table of results is given. Pb concn. ranged from 0.25 to 21.00 parts/billion (p.p.b.); Cd concn. ranged from not detectable to 23.0 p.p.b. This method gave a coeff. of variation of ± 0.02 p.p.b. for a Pb concn. of 0.2 p.p.b., and a coeff. of variation of ± 0.1 p.p.b. for a Cd concn. of 1 p.p.b. AJDW

35

[Cd, Pb and Cu concentrations in meadow fungi.] Cadmium-, Blei- und Kupferkonzentrationen in Wiesenpilzen.

Schellmann, B.; Opitz, O.

Lebensmittelchemie und Gerichtliche Chemie 32 (5) 97-98 (1978) [12 ref. De] [Inst. für Rechtsmed. Univ. Erlangen-Nürnberg, Universitätsstrasse 22, 8520 Erlangen, Federal Republic of Germany]

Cd, Pb and Cu were determined by polarography in 31 samples of (i) *Psalliota campestris*, 8 samples of (ii) *Tricholoma saevum*, and 5 samples of (iii) *Boletus badius*. Ranges of values for heavy metal concn. were, for (i), (ii) and (iii) resp. (mg/kg DM basis): Cd 0.2-2.2, 0.2-0.4 and 0.1-0.5; Pb 0.1-1.0, 0.1-0.4, and 0.3-0.5; and Cu 5.1-32.1, 9.8-21.7 and 4.9-29.0. These results are discussed in relation to literature data. It is concluded that the heavy metal concn. observed in (i), (ii) and (iii) present no health hazard. AJDW

36

Concentration of cadmium, copper, lead, and zinc in six species of freshwater clams.

Anderson, R. V.

Bulletin of Environmental Contamination and Toxicology 18 (4) 492-496 (1977) [12 ref. En] [Dep. of Biol. Sci., N. Illinois Univ., DeKalb, Illinois 60115, USA]

6 spp. of clams (*Lampsilis siliquoidea*, *Lampsilis ventricosa*, *Strophitis rugosus*, *Sphaerium*, *Anodonta marginata* and *Lasmigona complanata*) were collected from the Fox River, Illinois and Wisconsin and the concn. of Cd, Cu, Pb and Zn in their shell and body was determined. There was considerable variability between the spp., but there were consistent trends in relationships between the metals. The order of metal concn. in the shells was Cd < Cu < Zn < Pb and for the body it was Cd < Cu < Pb < Zn. Metal concn. in the bodies of the freshwater clams studied generally reflected that found in the environment, with the exception of Zn. The shell had comparatively lower concn. of all metals. When the body was separated into general regions it was found that metal concn. were highest in the gills than muscle or viscera. VJG

37

Trace metals in sea scallops, *Placopecten magellanicus*, from eastern United States.

Greig, R. A.; Wenzloff, D. R.; MacKenzie, C. L., Jr.; Merrill, A. S.; Zdanowicz, V. S.

Bulletin of Environmental Contamination and Toxicology 19 (3) 326-334 (1978) [9 ref. En] [Nat. Marine Fisheries Service, Northeast Fisheries Cent.,

Milford Lab., Milford, Connecticut 06460, USA]

A standard sea scallop dredge and bag was towed for 15 min at each of 42 stations along the middle Atlantic coast from eastern Long Island to Cape Hatteras, North Carolina. The catch from each tow was immediately processed into muscle, gonad and total visceral mass portions, for trace metal analysis. Tabulated data show the metal concn. (Ag, Cd, Cr, Cu, Hg, Ni, Pb and Zn) in the muscle, gonads and total visceral mass. Most metal concn., except Zn, in muscle tissue of the scallops were below detection limits of the methodology used. Zn levels range from about 2 to 8 p.p.m. In contrast to muscle, Ag, Cd, Cu and Zn were present in detectable concn. in gonads of scallops. Only Hg and Pb concn. were generally below detection limits for total visceral mass. Comparisons of the present data with those obtained on scallop muscle from the UK and New Zealand are shown. VJG

38

Historical and current heavy metal residues in Hudson River fish.

Rehwoldt, R. E.; Mastrianni, W.; Kelley, E.; Stall, J. *Bulletin of Environmental Contamination and Toxicology* 19 (3) 335-339 (1978) [9 ref. En] [Marist Res. Inst., Marist Coll., Poughkeepsie, New York, USA]

This investigation deals with fish taken from the Hudson River during 1976 and 1977 and museum samples from the same water system captured between 1934 and 1973. Tabulated data present the average values for Pb, Hg and Cd (mg/g dry wt.) for the following fish: alewife (*Alosa pseudoharengus*), Atlantic sturgeon (*Acipenser oxyrinchus*), fundulus killifish (*Fundulus diaphonus*), small-mouth bass (*Micropterus dolomieu*), spot-tail shiner (*Notropis hudsonius*), striped bass (*Morone saxatilis*), sunfish (*Lepomis gibbosus*) and white perch (*Morone americana*). The results do not seem to follow any chronological relationship. The only apparent relationship that seems to exist is that between the feeding habits of the spp. and the residues. The predators are higher in Hg. Pb and Cd do not seem to be dependent upon feeding habits. VJG

39

[Natural and other toxic materials in food.]

Ammon, R.

Elelmezesi Ipar 32 (9) 328-335 (1978) [Hu, en, de, ru] [Univ. des Saarlandes Physiol.-Chem. Inst., 6650 Homburg, Federal Republic of Germany]

Aspects considered in this discussion of toxic materials in food include: pollen-derived toxic materials in honey; poisonous fungi; cyanides; tetrodotoxin in fugu fish; dinoflagellate toxins in shellfish; *Clostridium botulinum* toxin; staphylococcal toxin; mycotoxins; monoamine oxidase inhibitors and their interaction with dietary amines; allergens; F; As; Pb; Hg; Cd; DDT; and biphenyl. AJDW

40

Modified Fenton's reagent for the destruction of organic matter in the spectrophotometric determination of lead, cadmium and mercury in sodium carboxymethylcellulose.

Cela Torrijos, R.; Perez-Bustamante, J. A. *Analyst* 103 (1233) 1221-1226 (1978) [18 ref. En] [Dep. de Quimica Analitica, Univ. de Sevilla, Duque de Najera s/n, Cadiz, Spain]

The analytical control of trace amounts of metals in products that are used in the food industry is of great importance. A modification of Fenton's reagent was applied successfully to the rapid and safe mineralization of samples of ≤ 10 g of sodium carboxymethylcellulose in order to determine Pb, Cd and Hg by spectrophotometric methods based on the use of dithizone. Recoveries and reproducibility were satisfactory at the 0.05-1.5 p.p.m. levels. AS

41

Determination of lead in fruit juices after concentration using immobilized ED3A.

Guedes da Mota, M. M.; Griepink, B.

Zeitschrift für Analytische Chemie 291 (2) 128 (1978) [2 ref. En] [Univ., Croesestraat 77a, Utrecht, Netherlands]

The previously described method, viz. preconcn. on ED3A-CPG column and AAS [see FSTA (1977) 9 12A801 and FSTA (1978) 10 2H240], was applied to citric acid solutions (10 g/l.) resembling apple and orange juice. Recoveries of 60-150 μ g added Pb/l. were 95% and 98%, resp. Comparable results were obtained with 2 samples of grape juice. Examination of the column for other heavy metals showed no Cd and Hg in the eluate, but 170 μ g/l. Cu and 45 μ g/l. Zn. RM

42

[Lead, cadmium and mercury contents of edible fungi.] Blei-, Cadmium- und Quecksilbergehalte in Speisepilzen. [Review]

Lorenz, H.; Kössen, M.-T.; Käfferstein, F. K. *Bundesgesundheitsblatt* 21 (13) 202-204 (1978) [22 ref. De, en] [Zentrale Erfassungs- & Bewertungsstelle für Umweltchemikalien des Bundesgesundheitsamtes, Postfach, 1000 Berlin 53]

Published data on the heavy metal contents (Pb, Cd and Hg) of edible fungi has been reviewed. A clearly elevated level of Hg exists in cultivated mushrooms (*Agaricus bisporus*), with a mean Hg content of 0.109 mg/kg fresh wt.; and in wild edible fungi (*A. campester*, *A. arvensis*, *A. abruptibulbus*, *Cantharellus cibarius*, and *Boletus edulis*) levels of Hg and Cd were considerably in excess of those of other vegetable foods (0.05-0.84 and 0.05-4.40 mg/kg fresh wt., resp.). It was concluded from model calculations of consumer exposure to these metals that a reduction in the consumption of edible fungi should be recommended. JRR

43

Metals in grains sold under various labels - organic, natural, conventional.

Chang, P.-T.; Salomon, M.

Journal of Food Quality 1 (4) 373-377 (1978) [19 ref. En] [Dep. of Food Sci. & Tech. Nutr. & Dietetics, Univ. of Rhode Island, Kingston, Rhode Island 02881, USA]

The metal concn. of barley, brown rice, cornmeal, and lentils purchased at random in each of 2 yr in

supermarkets and in health and natural food stores which served as outlets for foods advertised as organic or natural, was determined. Samples were ground to pass a 20 mesh screen and stored at 4° C in the dark. Cd, Cu, Fe, Pb and Zn were analysed using methods recommended by Anderson [Atomic Absorption Newsletter (1972) 11 (4), 88-90] and Giron [Atomic Absorption Newsletter (1973) 12 (1), 28-29]. The metal concn. for all grains analysed are tabulated. Little or no statistical significance was found in differences between the conventional, natural and organic grains, in most cases. There appeared to be more Zn and Pb in organic corn meal than the natural but more Cu in the natural. Average levels (range) of metals (μ g/g) in grains were: Fe, 13-117; Zn, 12-42; Cu, 0.8-9; Pb 0.5-7, and Cd 0.09-0.4. Lentils were found to accumulate higher levels of metals than the cereal grains. SP

44

Effects of some heavy metals on oats in pot experiments with three different soil types.

Sorteberg, A.

Journal of the Scientific Agricultural Society of Finland 50 (4) 317-334 (1978) [14 ref. En, fi] [Dep. of Soil Fertility & Management, Agric. Univ. of Norway, 1432 As-NLH, Norway]

An account is given of 2 pot experiments with oats, 1 of which (1973-1976) included all combinations of 5 heavy metals (Cd, Co, Pb, Hg and Ni), 3 rates of each metal (0, 50 and 250 mg/pot), 2 rates of lime and 3 types of soil. The other experiment (1974-1976) was similar but used only Cd and Hg at levels of 0, 0.5 and 5 mg/pot. Crop yields and heavy metals in the crops (grain and straw) were determined and soil analysis was performed; results are tabulated. Contents of Cd, Ni, Co and Hg in the grain were increased with the application of 250 mg/pot of these metals; application of even 0.5 mg Cd/pot resulted in a distinct increase in Cd content of grain. Hg at 0.5 and 5 mg only had a slight effect. The content of metals decreased throughout the experimental period, and the effect of Hg was minimal in the 4th year even at the highest application rate. Addition of Pb led to only moderate increases in Pb content of grain. Heavy liming tended to reduce the content of heavy metals (except Pb) in grain. AL

45

[The content of heavy metals in marine organisms from the sea off North-West Africa.] Zum Gehalt einiger Schwermetalle in marinen Organismen aus dem Auftriebsgebiet vor NW-Afrika.

Brüggemann, L.

Fischerei-Forschung 16 (2) 53-58 (1978) [48 ref. De] [Inst. für Meereskunde, Rostock-Warnemünde, German Democratic Republic]

Pb, Cd, Cu and Zn were determined by inverse voltammetry in samples of various marine organisms (including phytoplankton, zooplankton, and shrimps) from the Atlantic ocean off the NW coast of Africa. Tables of results are given. Heavy metal concn. in 2 samples of shrimps were (μ g/g dry wt.): Zn 562 and 42; Cd 8.9 and 11.5; Pb 2.8 and 3.1; and Cu 41.2 and 12.7. Enrichment factors for heavy metals in shrimps were: Zn 5000; Cd 17 000; Pb 290; and Cu 1000. Literature data for heavy metal concn. in various types of fish and shellfish are also discussed. AJDW

46

Mercury, arsenic and cadmium in the unfried and fried fish.

Anand, S. J. S.

Journal of Radioanalytical Chemistry 47 (1/2) 93-97 (1978) [7 ref. En] [Air Monitoring Sect., Bhabha Atomic Res. Cent., Trombay, Bombay-400 085, India]

Detn. of Hg, As and Cd in unfried and fried samples of fish, *Pampus argentius* (pomfret), was carried out by neutron activation followed by chemical separation to remove the interfering activities of Cu, Zn etc. Losses of Hg on frying (for 4-7 min) ranged from 11.4% to 43.7% in 8 samples of fish; data are tabulated. Thus frying can reduce the Hg burden of fish to a limited extent, but As and Cd burdens remained unaffected. AL

47

[Lead (Pb) and cadmium (Cd) contents in the meat and organs of slaughter cattle. I. Cattle from a relatively unpolluted region.] Untersuchungen über den Blei(Pb)- und Cadmium-(Cd)-Gehalt in Fleisch und Organen von Schlachtrindern. I. Rinder aus einem wenig umweltbelasteten Gebiet.

Kreuzer, W.; Kracke, W.; Sansoni, B.; Wissmath, P. *Fleischwirtschaft* 58 (6) 1022-1030; 957 (1978) [63 ref. De, en] [Inst. für Hygiene & Tech. des Lebensmitteltierischen Ursprungs, Univ. München, Veterinärstrasse 13, 8000 Munich 22, Federal Republic of Germany]

Meat, liver and kidney samples from 299 head of beef of varying age, sex and feeding system, from a mainly agricultural pre-alpine region with little industry or traffic were analysed for Pb and Cd contents. Tabulated results showed the following median and mean values resp. (p.p.m. fresh wt. basis): Cd, meat <0.005 and <0.005, liver 0.050 and 0.061, kidney 0.230 and 0.341; corresponding values for Pb were <0.05 and <0.05, 0.14 and 0.15 and 0.31 and 0.35 resp. Ratios between concn. in the tissues were (median and mean resp.) Cd kidney:liver 4.6 and 5.1, liver:meat >10 and >12.2, and kidney:meat >46 and >62.8; corresponding values for Pb were, resp. 2.2 and 2.3, >2.8 and >3.0, >6.2 and >7.0. Great variations were observed in individual liver and kidney values around the median. Animals with high Pb or Cd levels in the kidneys also had high levels in the liver. Highly significant relations were observed between the age of the animals and kidney Cd contents and between Cd and Pb contents, in both kidneys and livers. No effect of sex, breed or feeding was observed. The max. levels proposed in the 1st and 2nd draft 1976 regulations were exceeded in 17% (Cd) and 5.4% (Pb) of kidney samples, in <1% of liver samples and in no muscle sample. RM

48

Lead and cadmium in decorated glass tumblers.

Availability of interagency task force report.

United States of America, Food & Drug

Administration

Federal Register 43 (242, Dec. 15) 58633 (1978) [En] [Washington DC, USA]

To ensure that decorated glasses pose no significant risk due to Pb or Cd, the lip and rim area (i.e., top 20 mm) of the decorated glass must not leach >50 p.p.m. Pb or >3.5 p.p.m. Cd by a modification of

the existing ceramic ware test procedure. A production lot is unacceptable if any unit in a randomly selected sample of 6 glasses exceeds the above levels. CAS

49

Yield and metal composition of lettuce and wheat grown on soils amended with sewage sludge enriched with cadmium, copper, nickel, and zinc.

Mitchell, G. A.; Bingham, F. T.; Page, A. L.

Journal of Environmental Quality 7 (2) 165-171

(1978) [31 ref. En] [Dep. of Soil Sci. & Agric. Eng., Univ. of California, Riverside, California 92521, USA]

Lettuce (*Lactuca sativa* L. var. *longifolia*) and wheat (*Triticum aestivum* L. 'Inia') were grown under greenhouse conditions on an acid and a calcareous soil amended with sewage sludge enriched with Cd, Cu, Ni or Zn to determine the relative toxicities of the metals and uptake characteristics of the test plants. Tissue concn. of the 4 metals are tabulated against soil contents for lettuce shoots and wheat leaves and grain. Individual metals differed greatly in their accumulations in plant tissues; in general they followed the order $Zn > Cd > Ni > Cu$, and accumulation was greater at higher soil concn. Soil characteristics had a considerable effect on heavy metal uptake. JRR

50

[Use of sewage sludge compost in mushroom cultivation, and influence of heavy metals on harvest quality.] Untersuchungen zur Verwendung von Müllkomposten in der Champignonzucht und zum Einfluss von Schwermetallen auf die Qualität des Erntegutes. [Lecture]

Grabbe, K.; Domsch, K. H.

Mushroom Science 9 (1) 209-220 (1976) [7 ref. De, en, fr] [Inst. für Bodenbiol., Forschungsanstalt für Landwirtschaft, Bundesallee 50, D-33 Braunschweig, Federal Republic of Germany]

Growth of mushrooms on composts manufactured from clarified sewage sludge, horse manure, or mixtures of the 2 was compared. Contents of Cu, Zn, Pb, Cd and Hg in the composts used are tabulated, as are accumulation factors in mushrooms for these metals in horse manure/sludge compost mixtures. Only those for Cu and Hg were >1, being 1.4-1.7 and 6.5-9.0, resp. Levels of Zn in mushrooms were high for horse manure compost (190 p.p.m. in mushrooms); these levels were only increased by 20% by use of sludge compost having 4 × higher Zn contents. Highest contents of other metals observed in mushrooms were Pb 20 p.p.m., Cu 200 p.p.m., Cd 7 p.p.m., and Hg 9 p.p.m. Toxic levels were not encountered in any case, and metal levels did not inhibit mushroom growth. [See FSTA (1979) 11 6J859.] DIH

51

[On the contents of heavy metals in rice.]

Myung Chan Kim; Ki Hwan Shim; Young Rae Ha *Korean Journal of Food Science and Technology* 10 (3) 299-305 (1978) [33 ref. Ko, en]

Cu, Pb, Zn, Ni, Hg, Cd, Cr and Mn contents of unhulled, brown, 70% polished and 90% polished rice of 2 var., Yusin and Milyang, grown in 4 cropping areas during 1976-1977 were analysed by AAS. Results of

analysis showed that heavy metal contents decreased with an increase in milling degree, but significant differences in heavy metal contents were not observed between cropping areas or rice var. Ranges of heavy metal content (p.p.m.) of rice were: Cu, 0.80-2.89; Zn, 3.23-17.60; Mn, 6.72-70.25; Pb, not detected-0.64; Cr, not detected-23.20; and Ni, not detected-40.64. Hg and Cd were not detected in polished rice, and only traces were detected in some samples of unhulled rice. [From En summ.] SP

52

Metal contaminants in milk and milk products.

International Dairy Federation

Bulletin, International Dairy Federation No. 105, 40pp. (1978) [186 ref. En] [41 Square Vergote, 1040 Brussels, Belgium]

The 7 chapters deal resp. with arsenic, Cd, Cu, Fe, Pb, Hg and Sn. Each chapter has a similar pattern, reviewing the metabolism, toxicology, legal limits, analytical methods, contents in milk and milk products, precautions necessary to reduce the content in milk and milk products, and graphical displays of contents and tolerances from up to 17 countries. JMD

53

[Ceramics, glass, vitreous enamelled items. Limiting values for extraction of hazardous constituents from food-contact items. Cold extraction.] Keramik, Glas, Email. Grenzwerte für die Abgabe gesundheitlich bedenklicher Stoffe aus Bedarfsgegenständen. Kaltextraktion.

Germany, Federal Republic of, Deutscher Normenausschuss

German Federal Republic Standard DIN 51 032, 3pp. (1977) [De]

Limiting values are specified for release of Pb and Cd from food-contact utensils, tested by the method specified in DIN 51 031, part I. Max. permissible values for ceramics, enamelled utensils and glass items with interior decoration are: shallow tableware, etc. Pb 1.0 and Cd 0.10 mg/dm²; deep tableware etc. Pb 5.0 and Cd 0.50 mg/l.; shallow ceramics or glass cooking vessels Pb 5.0 and Cd 0.05 mg/dm²; deep ceramics or glass cooking vessels Pb 2.5 and Cd 0.25 mg/l.; and deep packs or storage containers Pb 2.5 and Cd 0.25 mg/l. Max. values for glass items without interior decoration are: shallow crystal glass items Pb 0.5 and Cd 0.01 mg/dm²; deep crystal glass items Pb 2.5 and Cd 0.05 mg/l.; shallow items made from other glasses Pb 0.1 and Cd 0.01 mg/dm²; and deep items made from other glasses Pb 0.5 and Cd 0.05 mg/l. Max. values for drinking vessels with a decorated border are Pb 2.0 mg/item, and Cd 0.20 mg/item. For these limiting values, shallow items are defined as those with a depth ≤ 25 mm. AJDW

54

[Surveillance of contamination of the food chain in France.]

Pomarola, H.

Medecine et Nutrition 12 (3) 169-178 (1976) [Fr, en] [Lab. du Min. de l'Agric., 25 Avenue de la Republique, 91305 Massy, France]

Surveillance of the food chain for contamination with radioelements, pathogenic microorganisms, parasites, pesticides and heavy metals in France is discussed, with reference to the legal situation, and activities of the Ministry of Agriculture. Control of use of food additives is also considered. AJDW

55

Metal contamination.

Whitman, W. E.

IFST Proceedings 11 (2) 86-90 (1978) [13 ref. En]

Pb, Hg, Cd, Be, Zn, Cu, Fe and Ni contamination and lack of Ca in foods are reviewed. SP

56

Mercury, arsenic, lead, cadmium, and selenium residues in fish, 1971-73 - National Pesticide Monitoring Program.

Walsh, D. F.; Berger, B. L.; Bean, J. R.

Pesticides Monitoring Journal 11 (1) 5-34 (1977) [14 ref. En] [Fish & Wildlife Service, U.S. Dep. of Interior, 17 Executive Park Drive, N.E. Atlanta, Georgia 30329, USA]

As part of the National Pesticide Monitoring Program, the Fish and Wildlife Service analysed numerous selected fish samples (from river systems, coastal streams, Hudson Bay drainage, Great Lakes drainage, and interior basins) from 100 monitoring stations throughout the USA for residues of Hg, As, Pb, Cd and Se in 1971-1973. At most stations, detectable residues of all metals were present in > 95% of the composite samples. Fish with Hg residues > 0.5 mg/kg wet wt. in the whole fish were mainly predators. Fish with residues of As, Pb, Cd and Se of > 0.5 mg/kg included predatory and non-predatory spp. Detailed results showing location, fish spp., size, number of fish and residues levels are given in tables for the 3 separate yr; only selected samples were analysed in 1973. Residues in the river fish analysed are based on wet wt. of the whole fish; the concn. in edible portions would probably be lower. AL

57

[Experimental studies of contamination of a food with lead, zinc and cadmium residues.]

Experimentelle Untersuchungen über die Belastung eines Nahrungsmittels mit Rückständen von Blei, Zink, Cadmium.

Otto, K.; Jekat, F.

Ernährungs-Umschau 24 (4) 107-109 (1977) [7 ref. De] [Fachbereich 19 - Ernährungswissenschaften, Univ., Giessen, Federal Republic of Germany]

40 samples of German and foreign honey obtained in 1975 from western Ruhr region markets were examined by AAS. Mean values with s.d. and ranges were: Zn, 11.1 ± 18.13 p.p.m. (0.64-62.66 p.p.m.); Pb, 0.149 ± 0.287 p.p.m. (0.024-1.667 p.p.m.); and Cd (37 samples), 11.79 ± 15.09 parts/billion (1.8-81.0 parts/billion). The findings are discussed from the public health viewpoint. SKK

58

Metal accumulation and depuration by the American oyster, *Crassostrea virginica*.

Greig, R. A.; Wenzloff, D. R.

Bulletin of Environmental Contamination and Toxicology 20 (4) 499-504 (1978) [9 ref. En] [Nat. Marine Fisheries Service, NE Fisheries Cent., Milford Lab., Milford, Connecticut 06460, USA]

Accumulation and depuration of Ag, Cd, Cu and Zn by oysters were studied in natural systems. Oysters were transferred from relatively unpolluted water of North Carolina to Milford Harbor water to determine uptake of metals, and oysters were transferred from the Housatonic River, Connecticut, to North Carolina water to determine depuration of these metals. Depuration studies were also carried out on oysters transferred from the Housatonic River to Milford Harbor. With 4 exceptions, significant uptake of Ag, Cd and Cu occurred in N. Carolina oysters exposed to different Milford Harbor water systems. No single treatment gave higher tissue residue levels of Ag and Cd than any other treatment, suggesting that Ag and Cd were not obtained directly from sediment. The Cu content of oysters held in unfiltered Milford Harbor water was significantly greater than all other treatments for the 11-wk exposure period. Data suggest that in addition to obtaining Cu from seawater, and/or their food these oysters obtained Cu either from suspended particulate or possibly directly from sediment. Zn concn. in oysters from North Carolina either significantly decreased or were not significantly different after exposure. Depuration studies indicate that oysters retain their metal content when transferred to relatively unpolluted waters. VJG

59

[Studies on accumulation of heavy metals by flat fish and shrimps.] Untersuchungen zur Akkumulation von Schwermetallen an Plattfischen und Garnelen. Dethlefsen, V.

Informationen für die Fischwirtschaft 26 (1) 27-28 (1979) [De] [Inst. für Küsten- & Binnenfischerei, Lab. II, Cuxhaven, Federal Republic of Germany]

Brief descriptions are given of aquarium studies on accumulation of Cd by dab, plaice, mussels and shrimps held in water with or without artificial contamination with Cd. Cd accumulated slowly in tissues of organisms held in water without artificial contamination with Cd, but more rapidly (especially in the liver) in those held in the Cd-contaminated water. Studies on effects of tetrapropylenebenzene sulphonate on Cd accumulation are briefly discussed. AJDW

60

Mercury, cadmium, lead, and arsenic in sediments, plankton, and clams from Lake Washington and Sardis Reservoir, Mississippi, October 1975-May 1976.

Price, R. E.; Knight, L. A., Jr. *Pesticides Monitoring Journal* 11 (4) 182-189 (1978) [26 ref. En] [Dep. of Biol., Univ. of Mississippi, University, Mississippi 38655, USA]

Mean concn. of Hg, Cd, Pb and As were highest in plankton, and levels were only slightly higher in clams than in sediments. Comparisons between clam size and trace metal concn. showed higher levels of Hg in the smaller clams. AL

61

[Residues of heavy metals in benthonic organisms of the Ligurian Sea.]

Viviani, R.; Cortesi, P.; Frignani, M.; Rossi, C. M. *Atti della Societa Italiana delle Scienze Veterinarie* 30, 585-588 (1976) [10 ref. It, en, fr] [Istituto di Biochimica, Fac. di Med. Vet., Univ. di Bologna, Bologna, Italy]

Data are given for concn. of metals (Fe, Ti, Al, Mn, Cr, Cd, Hg) in abdominal muscle tissue of scampi (*Nephrops norvegicus*) from various locations in the Ligurian Sea. Max. values recorded (p.p.m. fresh wt. basis) were: Fe 5.74; Ti 0.29; Al 7.47; Mn 1.09; Cr 0.29; Cd 0.10; and Hg 1.14. Considerable differences in metal concn. were observed between scampi caught at different sites. AJDW

62

[Seasonal variation in heavy metal contents in fishery products from an area of the Adriatic Sea off the coast of Emilia-Romagna.]

Viviani, R.; Cortesi, P.; Serrazanetti, G. P.; Poletti, R. *Atti della Societa Italiana delle Scienze Veterinarie* 30, 589-592 (1976) [9 ref. It, en, fr] [Istituto di Biochimica, Fac. di Med. Vet., Univ. di Bologna, Bologna, Italy]

A table of data is given for concn. of Hg, Pb, Cd, Cr, Mn and Ti in samples of clams (*Venus gallina*), cuttlefish (*Sepia officinalis*), shrimps (*Squilla mantis*), pilchards (*Sardina pilchardus*), anchovy (*Engraulis encrasicolus*) and sole (*Solea solea*) from the area specified in the title, studied over the period Dec. 1973-Oct. 1974. AJDW

63

[Initial results of studies on the heavy metal content of mussels, *mytilus galioprovincialis*, from the east coast of Sicily.]

Sarro, F. *Atti della Societa Italiana delle Scienze Veterinarie* 30, 595-597 (1976) [4 ref. It] [Istituto di Zootechnia Generale, Univ. di Catania, Catania, Italy]

Studies on the heavy metal contents in mussels from 3 sites on the east coast of Sicily are described; a table of results is given. Ranges of values (p.p.m. dry wt. basis) were: Cd 0.78-3.15; Mn 4.52-6.99; Cu 8.35-15.00; Mo 20.40-24.00; Co 3.75-4.46; Ti 1.60-2.09; Ni 37.33-40.16; Pb 0.5 (only 1 value given); Hg 0.001-0.003; and Zn approx. 100-250. AJDW

64

Hepatic and renal metallothionein concentrations in cows, swine, and chickens given cadmium and lead in feed.

Verma, M. P.; Sharma, R. P.; Street, J. C. *American Journal of Veterinary Research* 39 (12) 1911-1915 (1978) [30 ref. En] [Dep. of Anim., Dairy & Vet. Sci., Utah State Univ., Logan, Utah 84322, USA]

This paper includes data for Cd concn. in the liver and kidney of cattle fed diets containing 0.18, 2.40 or 11.29 µg Cd/g for 12 wk, pigs fed diets with 0.23, 2.41 or 10.12 µg Cd/g for ≤24 wk, and laying hens fed diets containing 0.32, 1.88 or 13.06 µg Cd/g for ≤24 wk.

Tissue Cd concn. in all 3 spp. increased with increasing dietary Cd level and treatment time. Max. values for Cd concn. in liver and kidney resp. were ($\mu\text{g Cd/g tissue}$, wet wt. basis): cows 3.21 and 8.83; pigs 10.29 and 42.26; and hens 26.27 and 165.67. Data are also given for metallothionein concn. in liver and kidney of cattle, pigs and hens fed diets with added Cd or Pb. AJDW

65

[Lead and cadmium contents of some tissues in normally-fed fattening pigs.] Blei- und Cadmiumgehalte in verschiedenen Geweben von Mastschweinen bei normaler Fütterung.

Vemmer, H.; Petersen, U.

Landwirtschaftliche Forschung Sonderheft 34/I, 62-71 (1978) [8 ref. De, en, fr] [Inst. für Tierernährung, Forschungsanstalt für Landwirtschaft, D-3300 Braunschweig, Federal Republic of Germany]

A feeding trial was done with 100 pigs given different vegetable protein feeds containing 1.2 mg Pb and 0.2 mg Cd/kg air-dry matter. At 100 kg live wt. the pigs were slaughtered, and Pb and Cd contents resp. were determined; mean values were (mg/kg, fresh tissue): renal cortex 0.18 and 0.55; liver 0.13 and 0.085; muscle 0.17 and 0.0032; subcutaneous fat 0.021 and 0.001; and rib 0.35 and 0.026. Pb in DM of the various tissues was about half that in the rations, Cd in DM of the renal cortex about 11 times as high as that in the rations, in the liver about the same level as in the ration, and in muscle, ribs and subcutaneous fat considerably less than that in the ration (6, 17 and 0.5%, resp., of the level in the diet). RM

66

Glazed ceramic ware: metal leaching.

Israel, Standards Institution of Israel

Israel Standard SI 1003, 4pp. (1978) [En]

This standard specifies the limits of leaching of Pb and Cd from glazed ceramic ware classified according to its intended use. Max. concn. of Pb and Cd (mg/l.), resp., in leaching liquid shall be: in tableware intended for foods and beverages, 3 and 0.3 (deep article), 5 and 0.5 (shallow article); similar tableware for use by children, 0.4 and 0.04; utensils intended for storage of foods and beverages, 0.4 and 0.04; cooking and baking ware, 3 and 0.3; and decorative ceramic ware which is not intended for use with food but can contain them, no requirements. Requirements for making the ware are given. Test methods for determining the concn. of Pb and Cd in leaching liquid are specified: leaching liquid to a level 5-7 mm below the upper edge of the article, and ambient temp. 22°C for 24 h; cooking and baking ware is heated to 120°C in an oil or sand bath, filled with boiling leaching liquid and heating continued for 2.4 h, then left at ambient temp. for 22 h before testing for Pb and Cd concn. AL

67

[Heavy metals in the legislation of EEC countries - public health problems.]

Billani, L.

Atti della Societa Italiana delle Scienze Veterinarie 30, 145-147 (1976) [It]

68

Determination of heavy metals in sea water and in marine organisms by flameless atomic absorption spectrophotometry. VIII. Digestion of biological materials.

Sperling, K.-R.; Bahr, B.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 168 (3) 193-194 (1979) [3 ref. En, de] [Biol. Anstalt Helgoland, Lab. Sülldorf, Wüstland 2, D-2000 Hamburg 55, Federal Republic of Germany]

A limitation of the authors' method for detn. of Cd in sea water [FSTA (1977) 9 7R358] is the occurrence of violent reactions during wet digestion of samples of wt. ≥ 2 mg, and consequent bursting-open of the stopper of the sample tube, and ejection of the samples. A simple tube rack/stopper clamp unit is described which prevents bursting-open of the stopper, and permits use of samples of wt. ≤ 5 mg. Larger samples may be digested if the tubes are cooled, and degassed at intervals during treatment. AJDW

69

[Cadmium in foods (occurrence, toxicology). A public health survey.] [Review]

Nesterin, M. F.; Konyshov, V. A.

Voprosy Pitaniya No. 2, 3-12 (1979) [105 ref. Ru] [Inst. Pitaniya AMN SSSR, Moscow, USSR]

70

[Residues of toxic metals and non-metals in foods of animal origin.] [Review]

Panebianco, F.

Atti della Societa Italiana delle Scienze Veterinarie 30, 116-138 (1976) [95 ref. It, fr, en] [Istituto di Ispezione degli Alimenti di Origine Anim., Univ. di Messina, Messina, Italy]

The review deals only with Cd, covering the contamination of air, water and soil, the metabolism and toxicity of Cd, its interaction with other elements, and its pathology in man and animals. The section on contamination of food includes meat, fish, milk and cheese. JMD

71

On the loss of cadmium, antimony and silver during dry ashing of biological material.

Raaphorst, J. G. van; Weers, A. W. van; Haremaker, H. M.

Zeitschrift für Analytische Chemie 293 (5) 401-403 (1978) [8 ref. En, de] [Netherlands Energy Res. Foundation (ECN), Petten, Netherlands]

The loss of Cd, Sb and Ag during dry ashing of seaweeds, mussels and shrimps was studied by radioactive tracers. Except for Sb, all biological material was labelled by uptake of radioactive tracers by the living organism. At ashing temp. $\leq 500^\circ\text{C}$ no significant loss by volatilization occurred. Results for Cd at higher temp. (550-900°C) appeared to depend on the composition of the organic material. Retention on the walls of the quartz crucibles did not cause significant losses. AS

72

[Physico-chemical analysis of drinking water. Determination of cadmium.]

Czechoslovakia, Urad pro Normalizaci a Mereni
Czechoslovak Standard CSN 83 0520, Part 38, 5pp.
(1977) [Cs]

This standard stipulates conditions for detn. of Cd by photometry (at concn. > 0.005 mg/l.) and AAS (at concn. ≥ 0.002 mg/l.). [See preceding abstr. for part 37.] HBr

73

Sewage sludge as a soil amendment, with special reference to Cd, Cu, Mn, Ni, Pb and Zn - comparison of results from experiments conducted inside and outside a glasshouse.

Vries, M. P. C. de; Tiller, K. G.

Environmental Pollution 16 (3) 231-240 (1978) [12 ref. En] [CSIRO, Glen Osmond, S. Australia 5064, Australia]

Lettuces and onions were grown in pots (16 kg dry soil) in a glasshouse, in mini-plots, $1 \text{ m} \times 1 \text{ m}$, outside that glasshouse and in a market garden on the same soil amended with 0, 1, 3 and 9 t ha^{-1} dried sewage sludge from a treatment plant serving a semi-industrial part of Adelaide, S. Australia. Edible parts of lettuce tops and onion bulbs were analysed for Cd, Cu, Mn, Ni, Pb and Zn. The sludge applications brought about a sharp increase of the metals, except Pb, in the plant material from the glasshouse, whereas there was generally little increase in the concn. in the field plants. Results of the mini-plots were in line with those of the field. The experiment has shown that glasshouse experiments can give completely erroneous indications of the probable uptake of heavy metals by vegetables on sludge-treated soils under field conditions. Differences are attributed to variations in soil and air temp. and humidity, soil moisture and light intensity; growth rates were faster in the glasshouse. Some of the implications of the uses of sewage sludge on farmland and in commercial glasshouses are discussed. AS

74

[Heavy metals in some vegetables.] Schwermetalle in einigen Gemüsearten.

Fritz, P. D.; Foroughi, M.; Ventner, F.

Landwirtschaftliche Forschung Sonderheft 33/II, 335-343 (1977) [49 ref. De, en, fr] [Tech. Univ. München, D-8050 Freising-Weihenstephan, Federal Republic of Germany]

To estimate possible accumulation of heavy metals in solids and crops, the metal content was determined in crops grown on soil which had not yet been fertilized with sewage sludge. Mixed samples of 10 leaf, fruit and root vegetable species grown on soils untreated by sewage sludge or sludge compost were analysed for Cu, Zn, Pb, Cr, Cd and Ni content. Tabulated results showed metal contents in the edible portion in the sequence $\text{Zn} > \text{Pb} > \text{Cu} > \text{Ni} > \text{Cr} > \text{Cd}$. The highest concn. were found in the leaves (spinach, celery leaf, lettuce, cabbage), and the lowest in fruits (beans, cucumber, tomatoes). The range of concn. were (p.p.m. on DM): Cu, 2-78 (celery leaf); Zn, 15-300 (spinach); Pb, 0-62 (radish); Cr, traces-14 (lettuce); Cd, not detected-4 (spinach); and Ni, not detected-18.5 (lettuce). RM

75

[Metal content of wheat grown in the Milan district.] Farini, A.; Genevini, P. L.; Vigano, P.

Tecnica Molitoria 30 (3) 153-159 (1979) [12 ref. It, en] [Istituto di Chimica Agraria, Univ. degli Studi di Milano, Milan, Italy],

164 samples of wheat grain from 80 locations in the Milan district were analysed for Cu, Pb, Cr, Zn, Ni and Cd by AAS. Max. values recorded (mg/kg DM) were Pb 10.35, Cr 0.33, Cu 22.44, Zn 105.80, Ni 1.53, and Cd 0.54. Block diagrams are given showing variation in the concn. of these metals in the wheat samples studied. The results are discussed in relation to literature data, and the significance of industrial pollution, motor vehicle exhausts, etc. as sources of heavy metal contamination. AJDW

76

[Chemical residues in milk. Development of contamination.]

Mouillet, L.; Luquet, F. M.; Mahieu, H.

Alimentation et la Vie 66 (2) 108-118 (1978) [8 ref. Fr] [Labcodral, 105 Rue de Universite, 59509 Douai, France]

The organochlorine pesticide and metal contamination of milk in France was studied between 1970 and 1976. Results, shown graphically and in tables, suggest progressive reduction in organochlorine residues, with fairly low levels from 1974 onwards. Heptachlor residues are falling from the excessive levels of the early 1970s to $< 100 \mu\text{g/kg}$, dieldrin and lindane are tending to stabilize at 50 and $100 \mu\text{g/kg}$, resp., and $(\alpha + \beta)$ -BHC is generally $< 100 \mu\text{g/kg}$ fat. Appreciable rises in Cu and Fe concn. takes place during processing of milk. Other metals (Mn, As, Cd, Hg, Pb) and F are present at low levels. RM

77

[Content of heavy metals (Cd, Cu, Hg, Ni, Pb, Zn) in sea trout from the Göttingen area of the river Leine.]

Gehalt an Schwermetallen (Cd, Cu, Hg, Ni, Pb, Zn) in Bachforellen im Leine-Raum Göttingen.

Abo-Rady, M. D. K.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 168 (4) 259-263 (1979) [22 ref. De, en] [Inst. für Physische Geographie, Senckenberganlage 36, D-6000 Frankfurt/M., Federal Republic of Germany]

Sea trout (3-4 yr old) were sampled from the river Leine up- and downstream of the town of Göttingen. Mean contents of the title metals (determined by AAS) are tabulated for muscle, liver and whole fish for the 2 sampling points. Of contents in muscle, only Cd level was significantly higher (at 5% level) in downstream than upstream samples, 0.016 ± 0.003 vs. $0.011 \pm 0.001 \mu\text{g/g}$ fresh wt. Levels in liver were significantly higher in downstream than upstream samples for Cd, Hg and Zn. Liver Ni contents were higher upstream than downstream; this is traced to pollution originating further upstream of Göttingen. Contents of all metals in muscle were lower than suggested max. allowable contents. DIH

78

Cadmium and zinc in muscle of bluegill (*Lepomis macrochirus*) and largemouth bass (*Micropterus salmoides*) from an industrially contaminated lake. Murphy, B. R.; Atchison, G. J.; McIntosh, A. W. *Environmental Pollution* 17 (4) 253-257 (1978) [18 ref. En] [Bionucleonics Dep., Purdue Univ., West Lafayette, Indiana 47907, USA]

Cd and Zn analysis of 44 largemouth bass and 29 bluegill indicated that fish in an ecosystem heavily contaminated by trace metals accumulated significantly more metal in the edible muscle tissue than fish in an uncontaminated ecosystem. Conc. found ranged from 0.010 to 1.308 p.p.m. Cd and 18.2 to 158.2 p.p.m. Zn in fillet muscle tissue (dry wt.). Bluegill contained significantly more ($P < 0.005$) Cd and Zn than bass, and small bass (< 100 g) contained significantly more ($P < 0.005$) Cd than larger bass. Muscle tissue contained only a small % of the total body burden of metals, and consumption of these fish is probably not a health hazard unless they constitute a major part of the diet. AL

79

Patterns of trace metal accumulation in crayfish populations.

Anderson, R. V.; Brower, J. E.

Bulletin of Environmental Contamination and Toxicology 20 (1) 120-127 (1978) [21 ref. En] [Dep. of Biol. Sci., N. Illinois Univ., Dekalb, Illinois, USA]

Concn. of Cd, Cu, Pb and Zn were investigated in 3 populations of crayfish, *Oronectes virilis* (Hagen), 2 collected at the same location (pool and river at Elgin) but at sampling sites with different inputs of trace metals, and the third from a site on the same river at Algonquin where metal input was low. Crayfish samples were separated by sex and 4 size groups. Some of the larger specimens were dissected to obtain gills, muscle, viscera and exoskeleton for body part analysis. The general relationship between metal concn. at the sites was $Cd < Pb < Cu \leq Zn$. Differences between the metal concn. at the sites were significant at the 0.01 level. Significantly higher concn. of Cd and Pb were found in crayfish taken from the river at Elgin compared to those collected in the pool at Elgin or the river at Algonquin. There were no significant differences in concn. of Cu or Zn between any of the 3 populations of crayfish. No significant differences in metal concn. were found between the sexes or size classes within sites. The lowest concn. of any of the metals was found in the muscle. The gills have significantly higher concn. of Cu compared to exoskeleton and muscle. The highest concn. of Pb was found in the exoskeleton $>$ gills $>$ viscera resp. Highest concn. of Zn was found in the gills and viscera. The highest Cd concn. were found in the gills. VJG

80

Heavy metals in mussels (*Mytilus galloprovincialis*) from the gulf of La Spezia and from the promontory of Portofino, Italy.

Capelli, R.; Contardi, V.; Fassone, B.; Zanichchi, G. *Marine Chemistry* 6 (2) 179-185 (1978) [12 ref. En] [Inst. of General & Inorganic Chem., Univ. of Genoa,

Genoa, Italy]

In different samples of *Mytilus galloprovincialis* Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb and Zn were determined by AAS. The mussels were taken from 11 sites in the Port of La Spezia. Typical concn. ranges ($\mu\text{g/g}$ dry wt.) were as follows: Cd, 2.0-6.8; Co, 0.8-3.2; Cr, 5.8-19.5; Cu, 6.9-33.7; Hg, 0.15-0.38; Mn, 11.8-37.8; Ni, 1.3-10.9; Pb, 13.9-44.6 and Zn, 203-379. Other samples were collected at 4 sites on the Promontory of Portofino and the following values were obtained: Cd, 0.8-1.1; Co, 2.6-2.9; Cu, 3.3-4.2; Hg, 0.09-0.15; Mn, 6.3-9.1; Ni, 1.2-2.4; Zn, 120-140. AS

81

[Determination of heavy metals and selenium in fish from the rivers and lakes of Upper Austria. II. Lead, cadmium, scandium, chromium, cobalt, iron, zinc and selenium.] Bestimmung von Schwermetallen und Selen in Fischen aus oberösterreichischen Gewässern. II. Blei, Cadmium, Scandium, Chrom, Cobalt, Eisen, Zink und Selen.

Teherani, D. K.; Stehlik, G.; Tehrani, N.; Schada, H. *Environmental Pollution* 18 (3) 241-248 (1979) [9 ref. De, en] [Inst. für Biol., Forschungszentrum Seibersdorf, A-2444 Seibersdorf, Austria]

119 samples of fish, which were caught in Sept. 1974 in Upper Austrian waters, were analysed for Zn, Fe, Co, Cr, Sc and Se content by neutron activation analyses and for Pb and Cd by AAS. The concn. values found for Zn ranged between 13 and 44 p.p.m., for Fe between 11 and 111 p.p.m., for Co between 0.01 and 0.40 p.p.m., for Cr between 0.02 and 0.21 p.p.m., for Pb between 0.01 and 0.28 p.p.m., with a single exception, for Cd between 0.01 and 0.13 p.p.m., and for Se between 0.62 and 2.02 p.p.m. The concn. of Sc was below the detection limit ($0.5 \text{ parts}/10^9$) for all fish samples analysed. AS

82

[Determination of traces of heavy metals by anodic stripping voltammetry with a glassy carbon electrode.]

Watanabe, F.; Takamura, K.

Annual Report of the Tokyo College of Pharmacy [Tokyo Yakka Daigaku Kenkyu Nenpo] 27, 748-754 (1977) [7 ref. Ja, en]

Anodic stripping voltammetry with a glassy C electrode was examined in detail in order to decide the optimum conditions for detn. of traces of some heavy metals. The method was applied to the detn. of Cu^{2+} and Pb^{2+} in waste water and glaze of some tablewares. The method is straightforward and simple to use for the detection and the detn. of Cu^{2+} , Pb^{2+} , Cd^{2+} , etc. in concn. of $\geq 1.0 \times 10^{-8} \text{ M}$. AS

83

[Heavy metals in food additives.]

Seco, M. M.

Alimentaria No. 100, 31-38 (1979) [12 ref. Es]

Aspects discussed include: definition of additives; the potential for cumulative toxicity of heavy metals; the need for certain heavy metals (Cu, Zn) in the diet; presence of Cu, Zn, Cd, Hg, Pb and As in foods, and sources of contamination; acceptable daily intakes of heavy metals; and analytical techniques for detn. of heavy metals in foods. AJDW

84

[Heavy metal contents in soils and plants after application of extremely high amounts of sewage sludge.] Schwermetallgehalte in Böden und Pflanzen nach extrem hohen Klärschlammgaben. Diez, T.; Rosopulo, A.

Landwirtschaftliche Forschung Sonderheft 33/1, 236-248 (1977) [13 ref. De, en, fr] [Bayerische Landesanstalt für Bodenkultur & Pflanzenbau, Menzingerstrasse 54, D-8000 München 19, Federal Republic of Germany]

The concn. of heavy metals were investigated in soils and crops after very high applications of sewage sludge (400-700 t in DM over a 50 yr period). High concn. of Zn, Cd, Cu, Cr, Pb and Hg were found in the soil. Concn. in the crops (wheat, barley, oats, corn, potatoes) were generally much higher (100- > 500 fold) in the vegetative portions than in grains and tubers. Cd, Cr and Ni were taken up more readily than Cu, Co, Pb and Hg. The absolute heavy metal contents in the portions used for food were not excessively high except for Cd; concn. of Cd (mg/kg DM) was 1.0-1.3 in wheat, 0.12-0.06 in barley, 0.42 in oat, 0.20 in maize kernels, and 0.36-0.54 in potato tubers. RM

85

[Effects of cadmium emissions on animal production.] Die Bedeutung von Cadmium-Emissionen für die landwirtschaftliche Tierproduktion. [Review] Boehncke, E.

Landwirtschaftliche Forschung Sonderheft 34/1, 44-61 (1978) [47 ref. De, en, fr] [Gesamthochschule Kassel, Nordbahnhofstrasse 1a, D-3430 Witzenhausen, Federal Republic of Germany]

This review deals with the effects of Cd in the environment on Cd-enrichment of plants, water and mixed feeds, Cd blood levels in and excretion by growing lambs, Cd concn. in blood, kidneys and liver of lambs, pigs and dairy cows, effects of Cd on Zn, Cu and Fe concn. in the liver, and Cd residues in meat, liver and kidneys of beef, (< 0.005, 0.005-0.3 and 0.04-1.66 mg/kg fresh wt., resp.), pork (0-0.19, 0.07-0.98 and 0.01-5.42 mg/kg, resp.) and poultry (0-0.039, 0-2.900 and 0-4.545 mg/kg, resp.). About 38% of the total Cd intake was derived from foods of animal origin, 42% from foods of vegetable origin. RM

86

Cadmium and the food chain: the effect of dietary cadmium on tissue composition in chicks and laying hens.

Leach, R. M., Jr.; Wang, K. W. L.; Baker, D. E. *Journal of Nutrition* 109 (3) 437-443 (1979) [24 ref. En] [Dep. of Poultry Sci., Pennsylvania State Univ., University Park, Pennsylvania 16802, USA]

The Cd content of body tissues and eggs was studied in broiler chicks and laying hens fed diets supplemented with 3, 12, and 48 µg Cd/g. The 48 µg level was selected as a slightly toxic level and the lower levels as representative of the amounts of Cd which would occur in feedstuffs due to environmental contamination. All levels of Cd resulted in increased Cd content of kidney while only 12 and 48 µg/g increased the Cd content of liver and muscle. Even 3 µg/g consistently increased the Cd content of liver and muscle but was not statistically

significant. Transfer of dietary Cd to the egg was very low; only the 48 µg/g level increased Cd content of the egg. This dietary treatment also resulted in reduced egg production and egg shell thickness. AS

87

[Heavy metals contents of fresh edible fungi in the Bavarian and Oberpfälz forest.] Zum Schwermetallgehalt von frischen Speisepilzen des Bayer. und Oberpfälzer Waldes. Böttger, M.

Industrielle Obst- und Gemüseverwertung 63 (16) 431-433 (1978) [28 ref. De] [Landesuntersuchungsamt für das Gesundheitswesen Nordbayern, Regensburg, Federal Republic of Germany]

Cd, Pb and Hg contents were determined in samples of 16 spp. of edible fungi collected in the Bavarian and Oberpfälz forest. Tabulated results showed mean Cd 0.34 p.p.m. fresh wt. basis (range, 2.76-0.02), Pb 0.23 p.p.m. (1.02-0.03) and Hg 0.07 p.p.m. (0.56-<0.001). Previously reported high Cd concn. in mushrooms (*Psalliota* spp.) were not confirmed, as most samples were *P. campestris*, which does not accumulate Cd. Low metal concn. were found in the popular spp. *Cantharellus cibarius* and *Xerocomus badius*. 73.6% of the samples were within the Federal German 0.05 p.p.m. tolerance for Hg and 92.7% were within the 0.05 p.p.m. tolerance for Pb (and at the lower limit of 0.5-0.2 p.p.m. Pb for vegetables and fruits). Only 26.8% were within the 0.1 p.p.m. limit for Cd. RM

88

Quantitative studies of mercury and cadmium deposition in Japanese quail through multiple generations.

Eskeland, B.; Gullvag, B. M.; Nafstad, I. *Acta Agriculturae Scandinavica* 29 (2) 113-118 (1979) [8 ref. En] [Dep. of Poultry & Fur Anim. Sci., Agric. Univ. of Norway, 1430 As-NLH, Norway]

This paper gives data from a 4-generation feeding trial with Japanese quail, fed diets with or without various Hg levels (≤ 8 p.p.m.) and, in the 3rd and 4th generations, with or without added Cd (≤ 15 p.p.m.). Tables of data are given for Pb and Cd concn. in tissues (brain, liver, heart) and in egg yolk, albumen and shell. Hg concn. in eggs and tissues tended to increase with increasing dietary Hg concn.; Cd concn. of tissues (but not eggs) increased with increasing dietary Cd concn. Effects of interaction between dietary Hg and Cd levels on tissue Hg concn. are described. AJDW

89

Trace metals in the common mussel, *Mytilus edulis* (L.), and in the alga *Fucus vesiculosus* (L.) from the region of the Sound (Öresund).

Phillips, D. J. H. *Environmental Pollution* 18 (1) 31-43 (1979) [29 ref. En] [Dep. of Zool., Univ., Uppsala, Sweden]

Concn. of Zn, Cd, Pb and Fe were determined in whole soft parts of mussels from a total of 20 locations in the area of the sound between Sweden and Denmark. Results for mussels agreed broadly with those reported previously for this region, indicating a northward

decrease in available metal concn. Mean Zn concn. ranged from 3.96 to 45 µg/g dry wt., Cd from 0.7 to 7.6 µg/g dry wt., Pb from 20 to 202 µg/g dry wt., and Fe from 39 to 346 µg/g dry wt. SP

90

Graphite-furnace atomic absorption spectrometric determination of lead and cadmium in foods after solvent extraction and stripping.

Dabeka, R. W.

Analytical Chemistry 51 (7) 902-907 (1979) [22 ref. En] [Div. of Food Res., Health Protection Branch, Health & Welfare Canada, Tunney's Pasture, Ottawa, Canada K1A 0L2]

Solvent extraction of Pb with ammonium pyrrolidine dithiocarbamate and methyl isobutyl ketone, i. e. the APDC-MIBK extraction system, was modified to enable detn. of Pb and Cd in foods with detection limits of 20 and 1 ng, resp. Metals were extracted from HNO₃-HClO₄ digests at pH 1.4-1.8 into MIBK (70 ml), stripped into HNO₃ (3%) and H₂O₂ (8%), and the stripping solution was modified with a solution of NH₃ and ammonium dihydrogen phosphate to optimize determinative precision and accuracy. Advantages were: few interferences and sample-size limitations (≤ 13 g dried kidney was analysed); consistent determinative precision (usually about 1% s/X using graphite-furnace atomization); good accuracy for 5 NBS standard reference materials; standards did not require extraction; and 'acid-soluble' and 'acid-insoluble' Pb could be sequentially determined. AS

91

[Environmental pollution with Pb, Cd and Cr, and effects on crops and foods in a defined area of the province of Rome.] [Lecture]

Bencivenga, B.; Pallotti, G.; Sanna, M.; Simonetti, T.; Bonifazi, M.; Porrozzio, G.

Bollettino dei Chimici dei Laboratori Provinciali 5 (1) 88-93 (1979) [15 ref. It] [Lab. Chimico Provinciale, Via Saredo 52, 00173 Rome, Italy]

Analysis of food produced in an area of 3600 ha near Rome airport (Fiumicino) for Pb, Cd and Cr contamination revealed max. Pb concn. (mg/kg) of 1.70 in vegetables, 0.97 in meat, 2.40 in liver, 0.30 in milk and 0.30 in wine; corresponding Cd concn. were, 0.08, 0.08, 0.32, 0.02 and 0.03; corresponding Cr concn. were 1.16, 1.30, 14.13, 0.04 and 0.09. Results showed that Pb contamination is the main health hazard. [See FSTA (1979) 11 11A776.] RM

92

[Release of lead and cadmium from porcelain and ceramic utensils. II. Release of toxic metals into foods.] Untersuchungen über die Abgabe von Blei und Cadmium aus Porzellan- und Keramikgeschirr. II. Schadmetallabgabe an Lebensmittel.

Dömling, H. J.; Kolb, C.

Deutsche Lebensmittel-Rundschau 75 (5) 152-156 (1979) [15 ref. De, en, fr] [Landesuntersuchungsanstalt für das Gesundheitswesen Nordbayern, Erlangen, Federal Republic of Germany]

Comparative studies on uptake of Pb and Cd from decorated porcelain or ceramic utensils by 4% acetic

acid solution and by acidic foods under identical test conditions are described. Foods studied included cultured dairy products, wine, beer, fruit juices, soft drinks, fruit and vegetable products, condiments, sauces, mineral water and coffee. Tables of data are given showing food product pH, the Pb and Cd concn. in the food before and after the test, Pb and Cd concn. in the 4% acetic acid solution after the test, and Pb or Cd uptake by food as % of uptake by the acetic acid test solution. Extremely high heavy metal uptake values were recorded for individual samples of cola drink and rhubarb compote (461.9 and 246.1% of the value for acetic acid solution, resp.); all other food samples had heavy metal uptakes lower than that for 4% acetic acid (0.4-83.7% for Pb, 9.3-86.8% for Cd). The relatively high levels of Pb and Cd which may be achieved suggest that holding of acidic foods in decorated ceramic or porcelain utensils may present a significant health hazard. [See FSTA (1978) 10 2C38 for part I.] AJDW

93

[Residue problems caused by heavy metals and arsenic in feed and food.] Rückstandsprobleme durch Schwermetalle und Arsen in Futter- und Lebensmitteln. Kühnert, M.; Fuchs, V.; Polo, C. A.

Monatshefte für Veterinärmedizin 34 (6) 206-212 (1979) [28 ref. De, en, ru] [Sektion

Tierproduktion & Vetmed., Karl-Marx-Univ. Leipzig, German Democratic Republic]

Problems with residues of Pb, Cd, Hg and As in foods are discussed, with reference to their toxicity, distribution within the body, accumulation in tissues, major sources of contamination, and possible interaction with other contaminants. Major sources of contamination of foods and feeds include industrial effluents and motor vehicle exhaust gases. Establishment of tolerances for heavy metals in foods is also considered. IN

94

Toxic trace metals in food. I. A new voltammetric procedure for toxic trace metal control of wines.

Golimowski, J.; Valenta, P.; Nürnberg, H. W.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 168 (5) 353-359 (1979) [38 ref. En, de] [Inst. of Chem., Nuclear Res. Cent. (KFA) Jülich, D-5170 Jülich, Federal Republic of Germany]

A procedure for detn. of the toxic trace metals Cu, Pb and Cd in wines is described, based on liberation of organically-bound heavy metals by addition of H₂O₂ and UV photolysis under a 500 W Hg lamp, followed by detn. by differential pulse stripping voltammetry using a Hg film electrode for Pb and Cd, and a gold electrode for Cu. Data are given for 5 wines, showing comparative results for heavy metal detn. by this technique and a method using wet digestion rather than UV photolysis. The results show that the photolysis procedure gives full liberation of organically-bound heavy metals. Detection limits and precision of the UV photolysis/voltammetric method are good. Interference by heavy metal contamination during the analysis was slight. It is concluded that this method is suitable for testing of wines for trace metals; the technique could easily be expanded to cover detn. of Hg or Zn. AJDW

95

Determination of cadmium, lead and copper in wine by differential pulse anodic stripping voltammetry. Oehme, M.; Lund, W.

Zeitschrift für Analytische Chemie 294 (5) 391-397 (1979) [19 ref. En, de] [Dep. of Chem., Univ. of Oslo, Box 1033, Blindern, Oslo 3, Norway]

The simultaneous detn. of Cd, Pb and Cu in wine by differential pulse anodic stripping voltammetry at the hanging Hg drop electrode is described. Wine samples are decomposed in a mixture of H_2SO_4 and H_2O_2 at $180^\circ C$. The procedure is controlled by recovery tests and compared with other wet digestion methods. Results for 5 red and 5 white wines of different origin are tabulated. Pb levels (0.065-0.230 p.p.m.) were below the accepted min. but some wines contained relatively large concn. of Cu (0.08-1.04 p.p.m.). Cd levels were very low (1.4-6.6 parts/billion). AS

96

Toxic trace metals in food. II. A comparative study of the levels of toxic trace metals in wine by differential pulse anodic stripping voltammetry and electrothermal atomic absorption spectrometry. Golimowski, J.; Valenta, P.; Stoeppler, M.; Nürnberg, H. W.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 168 (6) 439-443 (1979) [18 ref. En, de] [Inst. of Chem., Nuclear Res. Cent. (KFA), D-5170 Juelich 1, Federal Republic of Germany]

A method consisting of UV-pretreatment followed by differential pulse anodic stripping voltammetry (DPASV) using an Hg film electrode (for Pb and Cd) or an Au electrode (for Cu) was compared with the more widely used electrothermal AAS method for analysis of toxic metals in wine. The AAS pretreatment is more rapid, but matrix problems with specific metals are encountered. Results for Cd are not compared as precise results are not obtainable with AAS below $1 \mu g/l$. Results of detn. of Pb and Cu in 32-34 wines are compared graphically for the 2 methods. For Pb correlation coeff. was 0.96 and slope angle of regression line was 38.6° ; for Cu these values were 0.98 and 53.9° , resp., if AAS samples were diluted with 2M HNO_3 (1:4), and 0.96 and 43.8° , resp. if AAS samples were diluted 1:4 with water. The findings confirm the value of study of a matrix with 2 independent methods of analysis. It is suggested that the better precision of the DPASV method would partially compensate for the longer pretreatment procedure, as fewer replicates would be required. Contents of Cd, Pb and Cu as determined by DPASV in 36 wines of vintage 1973-1977 from Germany, France and Italy are tabulated. Ranges found are ($\mu g/l$) Cd 0.2-3.2, Pb 48-170 (+ 1 sample 467), and Cu 20-780 (+ 1 sample 2000). [See FSTA (1979) 11 11H1779 for part I.] DIH

97

[Determination of cadmium binding proteins in the edible mushroom (*Agaricus arvensis* Schff. ex Fr.).] Untersuchungen über cadmiumbindende Proteine im Schaf-Champignon (*Agaricus arvensis* Schff. ex Fr.). Kruse, H.; Lommel, A.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 168 (6) 444-447 (1979) [16 ref. De, en]

[Untersuchungsstelle für Umwelttoxikologie des Landes Schleswig-Holstein, Fleckenstrasse, D-2300 Kiel, Federal Republic of Germany]

Isolation and characterization of Cd compounds from *Agaricus arvensis* Schff. ex Fr. are described. These compounds were extractable with buffers. Ultrafiltration and protein precipitation suggested protein bound Cd. Mushroom proteins were separated by gel chromatography and Cd content in the corresponding fractions was determined by flameless AAS. 2 Cd-containing protein fractions were found with Cd concn. of 2.1 and 1 mg/g protein, resp. The mol. wt. of both Cd-containing proteins were estimated to be about 2000 and 15 000-20 000, resp. by comparison with standard proteins. AS

98

Sexual maturation as a source of variation in the relationship between cadmium concentration and body weight of *Mytilus edulis* L.

Cossa, D.; Bourget, E.; Piuze, J.

Marine Pollution Bulletin 10 (6) 174-176 (1979) [7 ref. En] [Inst. Nat. de la Recherche Sci., INRS-Océanologie, Rimouski, Quebec, G5L 3A1, Canada]

In order to refine the use of *Mytilus edulis* as a pollution indicator species, the relationship between Cd concn. and mussel body wt. was investigated at different sites in the Estuary and Gulf of the St. Lawrence. Data show that regression coeff. become considerably more variable when animals enter adulthood and the variations are probably related to biochemical changes occurring during the sexual cycle. Monitoring of marine pollution can be substantially improved by using only immature mussels. AS

99

[A rapid decomposition process for large samples of biological materials and its use in the determination of trace amounts of heavy metals.] Schnellverfahren für den Aufschluss von grösseren Mengen an Biomaterial zur analytischen Erfassung von Schwermetallspuren.

Scheubeck, E.; Nielsen, A.; Iwantschegg, G.

Zeitschrift für Analytische Chemie 294 (5) 398-401 (1979) [12 ref. De, en] [Siemens AG, Postfach 3240, D-8520 Erlangen, Federal Republic of Germany]

20 g samples of biological material with 70-80% moisture content were pre-dried in a closed pressure vessel and then burnt in O_2 . All traces of heavy metals appear quantitatively in a solution consisting of the condensates from drying and combustion products of the organic matrix. Decomposition takes < 30 min. Hg, Cd, Pb and As at concn. of 50-250 parts/billion or in amounts of 1-5 μg were detected in beef or pork meat, liver and kidney with recoveries of 80-90%. AS

100

Trace metal content of livers and kidneys of cattle. Flanjak, J.; Lee, H. Y.

Journal of the Science of Food and Agriculture 30 (5) 503-507 (1979) [17 ref. En] [Div. of Analytical Lab., Health Commission of NSW, PO Box 162 Lidcombe, 2141 NSW, Australia]

Results are presented for levels of trace metals as

determined by AAS, in livers and kidneys of 190 cattle from 8 different locations in New South Wales. Mean and range for each of the trace metals, in p.p.m., in livers and kidneys, resp. were as follows (nd = not detected): As 0.013 (nd-0.09) and 0.018 (nd-0.10); Cd 0.08 (nd-0.80) and 0.43 (0.02-10.7); Cr 0.05 (nd-1.0) and 0.03 (nd-0.22); Co 0.07 (nd-0.45) and 0.03 (nd-0.25); Cu 18.0 (0.81-82.8) and 3.9 (1.84-9.2); Pb 0.14 (nd-0.85) and 0.22 (nd-2.29); Mn 2.72 (1.11-4.09) and 1.07 (0.58-1.67); Hg 0.005 (nd-0.050) and 0.006 (nd-0.177); Mo 0.88 (nd-2.41) and 0.31 (nd-1.85); Ni 0.33 (nd-4.82) and 0.46 (nd-5.80); Se 0.17 (0.01-0.63) and 1.10 (0.47-1.77); and Zn 37.5 (13.4-99.2) and 18.6 (12.9-31.6). Significant differences were observed in the trace metal levels in livers and kidneys from the different regions of the State and between the trace metal levels in livers and kidneys from the same region. Accuracy of the methods was confirmed by analysis of NBS No. 1577 Bovine Liver. AS

101

[Hygienic evaluation of foods from the standpoint of their contamination with harmful metals. II. Pb, Cd, Zn and Cu in 20 staple foods.]

Nikonorow, M.; Piekacz, H.

Roczniki Panstwowego Zakladu Higieny 29 (6) 611-626 (1978) [22 ref. Pl, ru, en] [Zaklad Badania Zywnosci i Przedmiotow Uzytku Panstwowego Zaklad Higieny, Warsaw, Poland]

During 1973-1974, contents of the title metals were determined in retail samples of market and dried milks, twarog (cheese), wheat and rye flours, mixed and rye bread, Graham and Poznan rolls, pork, beef, veal, chicken, hen's eggs, tomatoes, carrots, potatoes, white cabbage and apples. Additionally, some samples were also analysed in 1976, and a comparison was made of all the results to determine whether regional differences and time of sampling were important. Analyses were made by AAS and colorimetry, and results are tabulated in detail. Overall results indicated that level of contamination of foods with Pb, Cd, Zn and Cu in Poland is comparable to that in other countries; place and time had no marked effect on the results (with a few exceptions, which are considered to require further study). [See FSTA (1978) 10 11C421 for part I.] HBr

102

[Square-wave polarographic determination of heavy metals in foods of plant origin with special reference to cadmium.] Square-wave-polarographische Bestimmung von Schwermetallen in pflanzlichen Lebensmitteln unter besonderer Berücksichtigung des Cadmiums.

Ruick, G.; Schmidt, M.

Nahrung 23 (1) 39-48 (1979) [65 ref. De, en, ru]

[Hygiene-Inst. Dessau, German Democratic Republic]

140 samples of foods of plant origin, mainly from a highly-industrialized region of the German Democratic Republic, were analysed for Cd by square-wave polarography. Tables of mean Cd concn. and ranges are given for (i) 26 types of fresh vegetables, (ii) 18 types of fresh fruit and nuts, (iii) 15 types of cereals and cereal products, (iv) 14 types of seasonings (herbs, spices, salt, vinegar), (v) 6 types of canned vegetables, etc., (vi) 7 types of soft drinks and fruit juices, (vii) 3 types of

beer, (viii) 13 types of semi-solid foods for babies, and (ix) 4 types of liquid foods for babies. Max. Cd concn. recorded for these 9 classes of foods were (mg/kg): (i) 0.235 (cabbage), (ii) 0.074 (orange), (iii) 0.20 (wheat); (iv) 0.70 (allspice); (v) 0.31 (canned spinach); (vi) 0.010 (orange juice); (vii) 0.001 (diabetic Pilsener); (viii) 0.159 (spinach with liver); and (ix) 0.051 (carrots/bananas). Comparison with literature data shows these results to be comparable to those recorded for other industrialized countries. AJDW

103

[Heavy metal contamination from food.] Lebensmittel als Quelle der Schwermetallbelastung des Menschen. Käferstein, F. K.

Schlachten und Vermarkten 78 (11) 372-374 (1978)

[9 ref. De] [Bundesgesundheitsamt, Postfach, 1000 Berlin 33]

The sources of excess heavy metals (Pb, Cd and Hg) intake from food are reviewed. Main sources of Pb are fruits and vegetables, liver and kidneys and bone particles, of Cd are some edible fungi, mussels, liver and kidneys, and of Hg are some edible fungi, fish and fish products. RM

104

Soluble zinc and cadmium in the drinking water supplies of Minneapolis and St Paul, Minnesota. Mustalish, R. W.

Dissertation Abstracts International, B 39 (1) 179: Order no. 78-09711, 267 pp. (1978) [En] [Univ. of Minnesota, Minneapolis, Minnesota 55455, USA]

Aim of the study was to design and test an integrated methodology for evaluating soluble trace metals in water supplies. Both Minneapolis and St Paul derive their raw drinking water from the Mississippi River and both cities treat the water by conventional methods. In Minneapolis, water withdrawn from the river is treated immediately. In St Paul, river water is pumped into a series of impounding reservoirs and withdrawn from the terminal reservoir for treatment; the water supply to the impoundments may be augmented by an auxiliary lake-chain water source. Mean soluble Zn and Cd levels in river water were resp., 3.0 and 0.09 µg/l. The impoundment system has essentially no effect on Cd levels but results in increased Zn levels. Atmospheric input is suggested as a factor in this increase. Conventional water treatment in both cities resulted in significant ($P = 0.05$) increase in soluble Zn and Cd, particularly the latter. Mean soluble Zn and Cd levels in treated water were, resp., 3.8-4.2 and 0.3 µg/l. It is suggested that the increases are due to a change in the chemical phase, with insoluble Zn and Cd being solubilized during post-coagulation/sedimentation. JA

105

Zinc, copper, lead and cadmium contents in Japanese green tea.

Tsushida, T.

JARQ (Japan Agricultural Research Quarterly) 11 (4) 211-214 (1977) [9 ref. En] [Tea Tech. Div., Nat. Res. Inst. of Tea, Japan]

Zn, Cu, Pb and Cd contents in samples of 139 green teas presented at the National Tea Contest at

Kagoshima in 1974 were determined by combination of isobutyl ketone extraction of iodide with AAS (Cu, Pb and Cd) and AAS alone (Zn). Ranges and means found ($\mu\text{g/g}$) were: Zn, 23.4–100.5 and 54.4; Cu, 4.7–36.5 and 11.4; Pb, 0.11–1.93 and 0.49; and Cd, 0.013–0.098 and 0.036. Changes in contents of these 4 metals in tea leaves during growth and development are shown. Cause of Pb contamination in some samples is also discussed briefly. VJG

106

Direct determination of copper, lead and cadmium in tea infusions by flameless atomic absorption spectrometry.

Tsushida, T.; Takeo, T.

Agricultural and Biological Chemistry 43 (6) 1347–1348 (1979) [8 ref. En] [Nat. Res. Inst. of Tea, Kanaya, Haibara, Shizuoka, Japan]

Cu and Pb concn. were determined in tea infusions by directly injecting 5 μl infusion into the carbon tube of the furnace for flameless AAS. Calibration curves were constructed by addition of appropriate metal concn. to tea infusions under test. Cu contents of 4 green and 3 black teas and of their 1st & 2nd infusions (3 g/100 ml water) are tabulated. Mean Cu content of green teas was 11.2 $\mu\text{g/g}$, and mean Cu concn. of 1st & 2nd infusions were 83.4 and 27.8 ng/ml, resp. Corresponding figures for black teas were 19.4 $\mu\text{g/g}$, and 127.5 and 64.0 ng/ml. Highest Cu content and concn. in infusions of green tea was given by Kagoshima and of black tea by Assam. Mean and range of Pb concn. of infusions (ng/ml) was for green tea 5.6 (4.3–9.8) and black tea 5.1 (0.6–13.3). Cd concn. in infusions were below the limit of detection, 0.2 ng/ml. DIH

107

[Pesticide residues and heavy metals in the 1974 and 1975 Federal German wheat and rye harvests.] Gehalt an Pflanzenschutzmittel-Rückständen und Schwermetallen in den deutschen Weizen- und Roggenernten 1974 und 1975.

Seibel, W.; Ocker, H.-D.

Landwirtschaftliche Forschung 32 (1/2) 186–196 (1979) [7 ref. De, en, fr] [Bundesforschungsanstalt für Getreide- & Kartoffelverarbeitung, Schützenberg 12, D-4920 Detmold, Federal Republic of Germany]

Analyses of about 200 samples/yr of Federal German bread rye and wheat in 1974 and 1975 showed a continuing fall in lindane, DDT and HCB contents. 2/3 of the samples contained lindane and HCB residues; DDT, α -HCH and aldrin were detected only in isolated cases. Only 1 of 200 samples exceeded the legal tolerance for lindane (0.345 p.p.m., vs. 0.1 p.p.m. tolerance). Hg contents were < 0.01 p.p.m. and Pb contents 0.04–0.4 p.p.m.; Cd contents showed a slight rise over previous yr, with 5% of wheat samples containing > 0.1 p.p.m. Pb contents were 0–0.18 p.p.m. (mean, 0.049–0.04) in wheat in 1974 and 1975 and 0.019–0.359 p.p.m. (mean 0.077) in rye in 1975. RM

108

Trace metals in some fish species of South Carolina.

Koli, A. K.; Sandhu, S. S.; Canty, W. T.; Felix, K. L.;

Reed, R. J.; Whitmore, R.

Bulletin of Environmental Contamination and Toxicology 20 (3) 328–331 (1978) [5 ref. En] [Dep. of Natural Sci., S. Carolina State Coll., Orangeburg, S. Carolina 29117, USA]

Samples of fish (shrimp, silver snapper, brown trout, mudfish, white bass and catfish) were collected from freshwater and saltwater sources of rivers, lakes and ocean of South Carolina. Sample flasks were incubated in a constant temp. stirring water bath at 58°C until a clear solution was obtained in reagent-grade nitric acid. Triplicate samples of fish muscle were analysed by wet digestion and dry digestion methods. Trace metal levels of Fe, Zn, Mn, Cd and Cu were determined, in these fish, by flame atomic absorption using a Perkin-Elmer Model 306 spectrophotometer. Hg detn. was based on the wet digestion technique. Trace metal content in the above 6 fish spp. ranged as follows (p.p.m.): Cu, 0.01 (shrimp) – 0.20 (brown trout); Fe, 0.30 (mudfish) – 7.4 (shrimp); Zn, 0.02 (catfish) – 5.2 (shrimp); Mn, 0.02 (silver snapper) – 0.25 (shrimp); Cd, < 0.01 (all except shrimp) – 0.03 (shrimp); and Hg, 0.12 (white bass) – 0.63 (mudfish). VJG

109

Concentrations of Cd, Cu, Mn, Pb, and Zn in fishes in a highly organic softwater pond.

Wiener, J. G.; Giesy, J. P., Jr.

Journal of the Fisheries Research Board of Canada 36 (3) 270–279 (1979) [52 ref. En, fr] [Savannah River Ecology Lab., Aiken, S. Carolina, USA]

Concn. of Cd, Pb and 3 essential metals (Cu, Mn and Zn) in stocked bluegill (*Lepomis macrochirus*) and in the following resident fishes: warmouth, largemouth bass (*Micropterus salmoides*), chain pickerel (*Esox niger*), red fin pickerel (*Esox americanus*), American eel (*Anguilla rostrata*) and lake chubsucker (*Erimyzon sucetta*), were studied in an acidic, highly organic pond on the southeastern US coastal plain. Tabulated results are presented. Concn. of Cu, Mn and Zn in stocked and resident fish were apparently homeostatically controlled in liver tissue, axial musculature, and whole body. VJG

110

Comparative studies on trace metal levels in marine biota. II. Trace metals in krill, krill products and fish from the Antarctic Scotia Sea.

Stoeppler, M.; Brandt, K.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 169 (2) 95–98 (1979) [40 ref. En, de] [Inst. of Chem., Nuclear Res. Cent., D-5170 Jülich, Federal Republic of Germany]

In whole krill, krill muscle tissue, krill products and in fillets of the antarctic fish *Notothenia rossi marmorata*, *Dissostichus eleginoides*, and *Notothenia gibberifrons* the levels of Cd, Pb, Cu, Ni, Hg and As were determined. Methods applied were electrothermal AAS for Cd, Pb, Cu, and Ni, cold-vapour and hydride-generation AAS for Hg and AS, resp., usually after HNO_3 pressure decomposition and for As followed by $\text{HClO}_4/\text{H}_2\text{SO}_4$ treatment. Quality control was performed by analysis of appropriate standard reference materials and working standards and by intercomparison with differential

pulse anodic-stripping voltammetry (DPASV) for Pb and Cd. Mean values obtained related to fresh wt. for krill muscle meat (46 ng Cd/g, ≤ 50 ng Pb/g, 380 ng Cu/g, 130 ng Ni/g, ≤ 20 ng Hg/g, and 340 ng As/g) and fillets of Antarctic fish (≤ 3 ng Cd/g, ≤ 100 ng Pb/g, ≤ 200 ng Cu/g, ≤ 150 ng Ni/g, ≤ 50 ng Hg/g, and 300-1500 ng As/g) confirm the absence of toxic risks for human food according to present knowledge. Due to the somewhat higher, but not excessive, trace metal contents of krill products, these should be more suitable as a protein rich animal feed. AS

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CADMIUM IN FOODS

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Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journals, patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES

EDITOR

1

[Collaborative study on the precisions of atomic absorption spectrophotometric determinations of cadmium, copper and lead in foods.]

Koizumi, H.; Yasui, A.; Tsutsumi, C.; Matsunaga, R.; Yoshikawa, S.

Report of the National Food Research Institute [Shokuryo Kenkyusho Kenkyu Hokoku] No. 34, 121-131 (1979) [6 ref. Ja, en] [Nat. Food Res. Inst., Min. of Agric., Forestry & Fisheries, Tokyo, Japan]

An atomic absorption spectrophotometry (AAS) procedure for heavy metal detn. was submitted to a 4-member collaborative study of precision, using samples of rye, rye powder and brown rice (dry ashed at 490°C for 8-20 h), and vegetable juice dry-ashed after addition of phosphoric acid. 2 methods of sample preparation were tested: a direct method in which the dry-ashed sample was taken up in 1N HCl and aspirated into the AAS flame; and a KI-methyl isobutyl ketone (MIBK) method in which the sample in 1N HCl was treated with conc. phosphoric acid and saturated KI, and the metal complexes then extracted into MIBK which was subsequently aspirated into the AAS flame. Within laboratories, the MIBK method was more precise for Cu detn. than the direct method, but between laboratories the direct method was better, with a permissible tolerance $<3 \times$ that of the within-laboratory value. In the case of Cd detn., within-laboratory precisions were about the same for both methods; between laboratories, the MIBK method was more precise than the direct method for the rye samples. In all detn. of Cu, Cd and Pb in spiked samples the MIBK method was better. Levels of Pb in the natural samples were too low to assess the relative precisions of the methods. [From En summ.] JRR

2

[Possibilities of contamination of foods with Cd.]

Preda, N.; Popa, L.; Ariesan, M.; Bordas, E. *Igiene* 27 (2) 151-156 (1978) [9 ref. Ro] [Inst. de Med. & Farmacie, Cluj-Napoca, Romania]

Studies on the potential for contamination of foods with Cd from food-contact plastics coloured with Cd-containing pigments are discussed. 5 pigments were studied: Papion medium Cd red 7480, Papion medium Cd yellow 3600, Papion Cd red orange 5550, Papion pale Cd yellow 1300 and Papion light Cd red 6300. Data are given for the extractability of Cd from the pigments or from polyethylene containing these pigments (at a level of 1%) into a 3% acetic acid solution, and for the acute and subacute toxicity of the pigments to rats and mice. The results show high toxicity of the pigments, and potential for considerable migration of Cd from plastics film into foods. Migration of up to 4.569 µg Cd/10 cm² plastics film area was observed. It is concluded that colouring of food-contact plastics with Cd pigments is undesirable. AJDW

3

[Contamination with lead and cadmium. Study of heavy metals in bottled water, tap water and non-alcoholic beverages.]

Meseguer Soler, M.; Farre Rovira, R. *Alimentaria* No. 104, 27-37 (1979) [6 ref. Es] [Dep. de

Bromatologia, Toxicologia y Analisis Quimico, Univ. de Barcelona, Spain]

An outline is first given of the procedures involved in 4 different TLC methods for analysis of heavy metals; with formation of diethyldithiocarbamates, diethylammonium diethyldithiocarbamates or dithizonates or using plates impregnated with EDTA. Relative merits and drawbacks of the 4 methods for analytical purposes are discussed. The 2nd method was used to determine the contents of Cd, Cu, Hg, Pb and Zn in numerous samples of bottled waters (including spring water), tonic waters, carbonated beverages, cola, natural mineral waters and mains water from 3 different areas. Results are given in terms of samples above or below the Spanish legal max. (0.01, 1.5, 0.001, 0.1 and 1.5 mg/l for Cd, Cu, Hg, Pb and Zn, resp.). HBr

4

[Lead and cadmium levels in meat and organ samples from horses, and possible effects on consumer health.] Blei- und Cadmiumbelastungen in Fleisch- und Organproben bei Pferden und mögliche gesundheitsschädliche Wirkungen für den Verbraucher. Holm, J.

Fleischwirtschaft 59 (5) 737-739 (1979) [8 ref. De, en] [Staatliches Veterinäruntersuchungsamt, Dresdenstrasse 6, 3300 Braunschweig, Federal Republic of Germany]

The muscle, liver and kidney of 68 horses from the Federal Republic of Germany and 40 from Poland were analysed for Pb and Cd contents by the AAS and graphite oven techniques. Tabulated results showed mean Pb contents of 0.04 p.p.m. (fresh wt.) in the muscle of animals from both countries, 0.89 and 0.27 p.p.m. resp. in the liver, 0.37 and 0.18 p.p.m. in the kidneys, Cd contents of 0.13 and 0.15 p.p.m. in muscle, 9.12 and 7.06 p.p.m. in liver and 43.49 and 57.59 p.p.m. resp. in the kidneys of animals from Germany and Poland resp. Assuming a tolerable weekly Cd intake from food of 0.4-0.5 mg, horsemeat would provide critically high levels. It is recommended that horse livers and kidneys be declared unfit for human consumption, and horsemeat analysed for Cd. RM

5

[Cadmium content of various foods of animal origin.] [Review]

Cantoni, C.; Renon, P.; Aubert, S. d' *Industria Alimentari* 18 (6) 481-484 (1979) [39 ref. It, en] [Istituto Ispezione Alimenti Origine Anim., Univ. degli Studi, Milan, Italy]

After a review of the literature, including a listing of Cd concn. reported in numerous foods during 1961-1976, the author lists means and ranges of Cd concn. found (by AAS) in 468 samples of fish and marine products (e.g. oysters, scampi, mussels), meats (beef, pork, chicken), eggs, cheese, yoghurt, and meat products (sausages, hams, bacon), as well as in 40 samples of calf organs (kidneys, liver, heart, brain). Cd concn. found ranged from 0.01 to 1.34 p.p.m. HBr

6

[Simultaneous inverse-voltammetric determination of cadmium, lead and copper in dried milk.] Zur simultanen invers-voltammetrischen Bestimmung von Cadmium, Blei und Kupfer in Milchpulver. Fariwar Mohseni, M.; Neeb, R.

Zeitschrift für Analytische Chemie 296 (2/3) 156-158 (1979) [11 ref. De, en] [Johannes-Gutenberg-Univ., D-6500 Mainz, Postfach 2980, Federal Republic of Germany]

The conditions for dry ashing decomposition and inverse differential pulse voltammetry for the simultaneous estimation of Cd, Pb and Cu in dried milk are described. Analysis of a commercial sample of skim milk (ash content 8% on DM) gave the following results ($\mu\text{g/kg}$): Cd 0.78 ± 0.05 , Cu 134.3 ± 8.5 , Pb 20.5 ± 0.8 . Analysis of 4 samples (3 replicates, ash content 7.5% on DM) gave mean values ($\mu\text{g/kg}$, \pm relative s.d.): Cd $1.1 \pm 12\%$, Pb $17 \pm 6\%$, Cu $81.6 \pm 7\%$. RM

7

Heavy metal residues in dulse, an edible seaweed. Sirota, G. R.; Uthe, J. F.

Aquaculture 18 (1) 41-44 (1979) [4 ref. En] [Tech. Branch, Halifax Lab., Fisheries & Oceans Canada, PO Box 550, Halifax, Nova Scotia, B3J 2S7, Canada]

Dulse (*Palmaria palmata* Guiry, formerly *Rhodomenia palmata*) is dried and consumed as a relatively common snack food on the east coast of N. America. Duplicate samples of dulse harvested from 3 geographically different areas (Dark Harbour and Front Island on Grand Manan Island, and Maces Bay on the mainland of New Brunswick) and a common holding tank were analysed for As, Cu, Cd, Pb, Se, Zn and Hg by flameless AAS. Concn. ranges ($\mu\text{g/g}$ dry wt.) were: As 5.50-7.50, Cu 3.90-6.34, Cd 0.97-2.65, Pb 0.688-3.50, Se 2.00-2.91, Zn 57.5-84.1, and Hg <0.02 . Moisture content ranged from 10.44 to 13.72%. Dulse appeared to be able to concentrate metals, with accumulation coeff. of 200 for Cu, 10 000 for Zn, and 3000 for As. AL

8

[Application of wavelength-dispersive X-ray fluorescence spectrometry in analysis of trace elements in foods.] Anwendung wellenlängendispersiver Röntgenfluoreszenz-Spektrometrie in der Spurenanalytik von Lebensmitteln.

Grote, B.; Montag, A.

Lebensmittelchemie und Gerichtliche Chemie 33 (5) 89-92 (1979) [10 ref. De] [Univ. Hamburg, Grindellallee 117, 2000 Hamburg 13, Federal Republic of Germany]

After a brief consideration of the basic principles of wavelength dispersive X-ray fluorescence spectrometry, a procedure for detn. of heavy metals in foods is described based on ashing the sample at 450°C , dissolving the ash in conc. HCl, reduction of Fe^{3+} , elimination of phosphate by precipitation with ZrOCl_2 , adjustment of the solution to pH 4, precipitation of heavy metals by means of sodium diethyl dithiocarbamate, and analysis of the precipitate by X-ray fluorescence spectrometry. Data are given for concn. of Co, Cu, Cd, Ni, Zn, Fe and Pb, determined by

this technique, in samples of various fruit, vegetable, meat or milk-based foods for infants, and for cinnamon, juniper berries, caraway seeds, cloves and parsley. Reproducibility was good, coeff. of variation ranging from 1.57% for Co to 7.5% for Pb. Detection limits for individual elements were (μg): Co 0.69; Ni 0.45; Cu 4.88; Zn 14.42; Fe 18.45; Cd 0.10; and Pb 1.00. Interference between individual trace elements was negligible. , AJDW

9

[Swiss food handbook. Instalment 16.] Schweizerische Lebensmittelbuch. 16. Lieferung. [Book]

Switzerland, Schweizerische Lebensmittelbuchkommission; Switzerland, Eidgenössische Gesundheitsamt 69pp. (1979) [De] Berne, Switzerland; Drucksachen- & Materialzentrale

This 16th installment of this loose-leaf handbook comprises Chapter 45, Heavy metals. It covers analytical methods (including AAS, polarographic and photometric techniques) for detn. of heavy metals, including As, Sb, Ba, Pb, Cd, Cr, Cu, Ni, Hg, Se, Th, Bi, Zn and Sn. Methods for ashing of the food sample under test are also given. A subject index is included. [See FSTA (1979) 11 8A580 for the previous part.] AJDW

10

[A pressure decomposition device for fast treatment of large amounts of biological and organic matter and its application to the determination of trace quantities of heavy metals.]

Druckaufschlusseinrichtung für die schnelle Aufbereitung von grösseren Substanzmengen aus Biomaterialien und organischen Substanzen zur analytischen Erfassung von Schwermetallspuren. Scheubeck, E.; Gehring, J.; Pickel, M.

Zeitschrift für Analytische Chemie 297 (2/3) 113-116 (1979) [7 ref. De, en] [Siemens AG, Postfach 3240, D-8520 Erlangen, Federal Republic of Germany]

A cylindrical pressure vessel with fast safety lock was used in a pressure decomposition apparatus developed for rapid combustion of biological samples (up to 20 g) in O_2 . The construction and chemical resistance of the material allow high recovery rate of Hg, As, Cd and Pb at 50-250 ng/g from meat, dairy products, vegetables and fats. The equipment is easy to handle and needs only cooling water and electric power supply. The principle, construction and operation are described, but no results of detn. are given. RM

11

Application of independent methods and standard materials: an effective approach to reliable trace and ultratrace analysis of metals and metalloids in environmental and biological matrices.

Stoeppler, M.; Valenta, P.; Nürnberg, H. W.

Zeitschrift für Analytische Chemie 297 (1) 22-34 (1979) [68 ref. En, de] [Inst. of Chem., Nuclear Res. Cent., PO Box 1913, D-5170 Jülich, Federal Republic of Germany]

The development of independent analytical procedures or working standards and standard

reference materials for trace analysis is discussed. The application of independent methods for detn. of Pb, Cd, Cu, Ni and Hg in natural waters and biological samples (including fish muscle and wine) and the current use of the NBS standard reference materials bovine liver and orchard leaves is described. Data from long-term storage studies of blood samples, and results of trace metal detn. in 2 working standards (fish muscle homogenate and algae) and in tentative future standard reference materials (dried whole blood, blood plasma, phytoplankton, human hair, 2 aquatic and 1 terrestrial plant material) are presented in tables. PA

12

Residues of cadmium in edible tissues or products of lactating cows, swine and layer hens after low-level dietary exposures.

Street, J. C.; Sharma, R. P.; Shupe, J. L.; Wagstaff, D. J. *Toxicology and Applied Pharmacology* 45 (1) 305 (1978) [En] [Utah State Univ., Logan, Utah, USA]

Cows and pigs were fed diets containing CdCl₂ (added to diets to give Cd levels approx. 2 and 10 p.p.m. above the normal dietary intake) for 3 months; some of the animals were subsequently fed a control diet to allow Cd depletion from the body. Laying hens were similarly treated but with a 6 wk treatment period followed by a 6 wk depletion period. Cd levels were determined in skeletal muscle, liver, kidney and bone of all animals, in eggs and in cows' milk. Milk and eggs showed no increases in Cd concn. during the treatment and depletion periods. Muscle samples also showed no consistent effect of Cd treatment. Consistent dose-time related increases of Cd were observed in livers and kidneys of all animals; the depletion periods resulted in no decrease in Cd contents of these organs. JA

13

[Migration of lead, cadmium, copper, zinc and antimony from porcelain vessels.]

Zawadzka, T.; Brzozowska, B.

Roczniki Panstwowego Zakladu Higieny 30 (2) 115-122 (1979) [4 ref. Pl, en] [Zaklad Badania Zywnosci i Przedmiotow Uzytku Panstwowego Zakladu Higieny, Warsaw, Poland]

The aim of the study was detn. of the degree of migration of Pb, Cd, Zn, Cu and Sb from porcelain tableware (dishes) with interior decorations. The investigations were carried out on dishes produced by 7 different manufacturers representing a broad range of decorative paintings. Results showed that Pb migrated in greatest amounts into 4% acetic acid during 24 h at room temp.; in about 90% of vessels tested Pb content was in the range 0-3 mg/l of postextraction fluid, with a max. of 20 mg/l. Cd migration was in the range 0-0.3 mg/l; Zn, Cu and Sb migrated in trace amounts, the highest values of these metals being 1.6, 0.1 and 0.1 mg/l resp. AS

14

Fundamental studies and applications of flameless atomic absorption using a wire loop atomizer.

Chauvin, J. V.

Dissertation Abstracts International, B 39 (11) 5342:

Order no. 79-11288, 162pp. (1979) [En] [Univ. of New Orleans, New Orleans, Louisiana, USA]

2 flameless atomizers, (i) a W-Re wire loop and (ii) a Varian Techtron Carbon Rod Atomizer (CRA 63), were employed for AAS studies of Cu, Cd, Mg, Be and Sn. The shape and size of the signal are governed by heating rate, final atomization temp., nature and flow rate of sheathing gases and response time of the readout system. The latter is more critical for (i) since it has a much faster heating rate than (ii). A mechanical recorder and an oscilloscope were used in the studies and it was found that, in order to increase the linear range of the calibration plots, slower heating rates with concomitant losses in sensitivity were necessary.

Excellent sensitivity, ranging from 0.2 pg for Mg to 50 pg for Sn, was obtained with (i); this sensitivity was comparable to that achieved with the more expensive and slower (ii). Interferences by various compounds were investigated for (i) and found to be comparable to literature values for graphite atomizers. Analysis of water, bovine liver and serum using (i) indicated accuracies of 80-100%; a procedure based on formation and extraction of SnI₄ was developed for analysis of inorganic Sn in sea water. JA

15

Binding forms of toxic heavy metals, mechanisms of entrance of heavy metals into the food chain, and possible measures to reduce levels in foodstuff.

[Review]

Lorenz, H.

Ecotoxicology and Environmental Safety 3 (1) 47-58 (1979) [82 ref. En] [Zentrale Erfassungs- & Bewertungsstelle für Umweltchemikalien des Bundesgesundheitsamtes, 1000 Berlin 33]

Chemical spp. of Hg, Cd and Pb occurring in the environment and the routes of entry of bound forms of these metals into human food are reviewed. Measures for reduction of heavy metal content of food are suggested, including choice of suitable substrate for mushroom growth to avoid high contents of Hg and Cd, adjustment of soil pH to control plant Pb uptake, and reduction of Cd content in effluents to reduce contamination of sea food. DIH

16

[Cd in edible plants grown in polluted areas.]

Cadmium in Nahrungspflanzen von kontaminierten Standorten.

Mack, D.; Schmid, R.

Deutsche Lebensmittel-Rundschau 75 (10) 309-311 (1979) [14 ref. De] [Chem. Landesuntersuchungsanstalt, Stuttgart, Federal Republic of Germany]

Sediment dredged from the river Neckar is applied to agricultural land, to a depth of ≤ 1 m. As one section of the river is polluted with Cd from a pigment factory, studies were conducted to evaluate the possible uptake of Cd by food plants grown at such locations. Samples from 4 sites treated with dredged sludge in 1959-1965, 1969, 1976 or 1977 were analysed for Cd by AAS. Tables of data are given for strawberries, barley, wheat, lettuce, red cabbage, white cabbage, cauliflower, sugar beet, celery, celeriac, potatoes, leeks, maize, spinach, radishes, rhubarb and scorzonera grown at these

4 locations, and also for comparable crops grown in non-Cd polluted soil. The results show that uptake of Cd from the soil differed considerably between species, cereals, celery and celeriac showing especially high uptake, followed by leeks, potatoes, lettuce and sugar beet. White cabbage showed little Cd uptake. Many samples of crops grown in the dredged material showed Cd concn. exceeding the Bundesgesundheitsamt 0.1 p.p.m. guideline. AJDW

17

Cadmium and the kidney. [Review]

Cooper, P.

Food and Cosmetics Toxicology 17 (1) 84-86 (1979) [12 ref. En] [British Ind. Biol. Res. Ass., Woodmansterne Rd., Carshalton, Surrey, UK]

Recent studies on the nephrotoxic effects of Cd in animals and man are reviewed, with particular reference to Cd pollution of water used in the rice fields of Japan. The possible involvement of other food constituents in Cd toxicity and the potential hazard from organic as well as inorganic Cd are discussed. VJG

18

[Contents of some metals in 17 species of higher fungi harvested at various natural sites.]

Bourlier, G.

Comptes Rendus des Seances de l'Academie d'Agriculture de France 64 (14) 1147-1156 (1978) [16 ref. Fr]

80 samples (17 spp.) of Basidiomycete fungi including some edible species (e.g. *Lepiota procera*, *Collybia fusipes*) were analysed by AAS for K, Ca, Mg, Mn, Zn, Cu, Co, Cd and Hg. Results were tabulated and analysed for frequency distribution, effects of species and of location on concn. While concn. of Ca, Mg, Mn, Cu, Zn and to a lesser degree K and Co were dependent on the sp., Cd and Hg concn. were affected by environmental pollution, varying from 1.25 to 64.5 and 0.08 to 13.9 µg/g DM resp. with the high concn. recorded in the Paris region. RM

19

[Heavy metals in foods. I. The content of Cd in raw cocoa and semi- and fully-processed cocoa products.]

Schwermetalle in Lebensmitteln. I. Über den Gehalt an Cadmium in Rohkakao und in Kakao-Halb- und Fertigprodukten.

Knezevic, G.

Deutsche Lebensmittel-Rundschau 75 (10) 305-309 (1979) [9 ref. De] [Fraunhofer-Inst. für Lebensmitteltech. & Verpackung, Tech. Univ. München. 8000 Munich 50, Federal Republic of Germany]

Studies were conducted on 86 samples of fermented cocoa beans of various origins, 19 samples of roasted cocoa nibs, and 74 samples of chocolate and cocoa products. Cd concn. were determined by AAS. Numerous tables of results are given. The results show that most samples of raw fermented cocoa nibs had Cd concn. below the recommended limit of 0.3 mg/kg; some samples from Venezuela, Arriba, Malaysia, Sabah and Sanches had concn. > 1 mg/kg, the highest value

recorded being 4.34 mg/kg for a sample from Arriba. Cd concn. decreased slightly as a result of roasting. Studies on various types of chocolate showed mean values and ranges for Cd concn. to be (mg/kg): milk chocolate 0.04, and 0.02-0.21; milk chocolate with nuts 0.04, and 0.02-0.37; semi-bitter chocolate 0.13, and 0.05-0.54; and bitter chocolate 0.36 and 0.05-0.69. These differences are attributable to differences in the amount and type of cocoa solids used. Filled chocolate bars contained 0.02-0.10 mg Cd/kg (mean value 0.04 mg/kg); chocolate contained 0.02-0.12 mg Cd/kg (mean value 0.04 mg Cd/kg). Cocoa powder contained 0.12-0.25 mg Cd/kg (mean value 0.15 mg/kg), whereas cocoa-flavoured instant drink powders contained 0.03-0.08 mg Cd/kg (mean value 0.06 mg/kg). AJDW

20

Determination of cadmium in polished rice by atomic absorption spectrophotometry,

Narasaki, H.

Abstracts of Papers, American Chemical Society 177 (1) ANAL 64 (1979) [En] [Dep. of Chem., Fac. of Sci., Saitama Univ., Shimo-Okubo, Urawa 338, Japan]

Low-temp. plasma ashing is a useful technique to treat a large quantity of organic materials. However, it takes a long time to approach complete ashing. In the present method samples are treated by halves in the asher and then decomposed by wet oxidation. Cd is extracted into 4-methylpentane-2-one (MIBK) as the diethyldithiocarbamate (DDTC) and is determined by AAS. In an IPC 1001-B plasma machine 5 g of polished rice was treated for 10 h. The residue was charred with 3 ml conc. H₂SO₄ in a Kjeldahl flask. A clear solution was obtained by repeated addition of 1 ml portions of 60% (w/w) H₂O₂. The solution was neutralized with aqueous ammonia and transferred to a separating funnel. After the addition of 5 ml of 25% (w/v) potassium sodium tartrate and 5 ml of 10% (w/v) sodium DDTC, Cd was extracted into MIBK. A Japan Jarrell-Ash AA-782 was used for AAS with a 10 cm slit burner at a lamp current of 5 mA. Overall recovery was 96.2%. Cd content of National Bureau of Standards Orchard Leaves was within the certified value. AS

21

Translocation and accumulation of seven heavy metals in tissues of corn plants grown on sludge-treated strip-mined soil.

Garcia, W. J.; Blessin, C. W.; Sandford, H. W.; Inglett, G. E.

Journal of Agricultural and Food Chemistry 27 (5) 1038-1094 (1979) [16 ref. En] [N. Regional Res. Center, USDA, Peoria, Illinois 61604, USA]

Corn (*Zea mays*) plants were grown on unamended soil on strip-mined land (original top soil displaced) and on soil amended by addition of anaerobically digested sewage sludge (25 t dry wt./acre). Contents of 7 metals in the 2 soils are tabulated. Soil pH was 7.4. Tabulated results show effect of sludge addition and of plant size on contents of these metals in various plant tissues (kernels, roots, leaves etc.) after harvest. No metal was accumulated in excessive quantities in kernels, which were considered safe for consumption from either soil. Ratios of contents in kernels from sludge-grown

plants: contents in those from unamended soil were as follows: Cd 0.44, Pb 0.56, Cu 0.66, Zn 0.84, Cr 1.24, Mn 1.25 and Hg 3.16. Highest metal concn. were observed in leaves and roots, lowest concn. in cobs and kernels. Sludge-grown roots were unsuitable for animal feeding. DIH

22

[Total content of Hg, Pb, Cd and Cr in the fauna and flora of the S. Gilla lagoon, Cagliari, Italy. Preliminary note.]

Arru, A.; Balestrieri, F.; Chiacchierini, E.; Magri, A. L.; Panzanelli, A.

Rivista della Societa Italiana di Scienza dell'Alimentazione 8 (3) 211-216 (1979) [20 ref. It] [Istituto di Zoologia, Univ. di Sassari, Sassari, Italy]

Data are given for concn. of Pb, Cd, Cr and Hg (determined by AAS) in samples of marine animals and seaweeds from the S. Gilla lagoon, which is polluted with domestic and industrial effluents. Values are included for the fish *Liza saliens*, *Atherina boyeri*, mullet (*Mugil cephalus*), eel (*Anguilla anguilla*), sole (*Solea vulgaris*), and bass (*Dicentrarchus labrax*), the molluscs carpet shell (*Tapes decussatus*) and mussel (*Mytilus galloprovincialis*), the crustacea shore crab (*Carcinus mediterraneus*) and common prawn (*Leander serratus*), and the seaweed (*Ulva lactuca*). Max. values recorded for the heavy metals studied were: Pb 70.0 p.p.m. (dry wt. basis) in shore crabs; Cd 5.00 p.p.m. dry wt. basis in shore crabs; Cr 13.0 p.p.m. wet wt. basis in carpet shell; and Hg 5.70 p.p.m. wet wt. basis in shore crabs. AJDW

23

Study on accumulation of heavy metals in sharks.

IV. Metal concentration in gummy sharks (*Mustelus manazo*).

Taguchi, M.; Shimizu, M.

Abstracts of Papers, American Chemical Society 177 (1) ENVR 237 (1979) [En] [Dep. of Fisheries, Fac. of Agric., Univ. of Tokyo, Bunkyo-ku, Tokyo, 113, Japan]

It is reported by several investigators that concn. of Hg in sharks is very high. The mechanism and the origin of this phenomenon have not been made clear in sharks. The authors have previously investigated heavy metals in dogfish (*Squalus mitsukurii*). Here the authors report concn. of heavy metals in muscle and other organs of gummy sharks (*M. manazo*). Samples were collected from the catch landed at the Fish Market of Choshi, Chiba, Japan, during Feb.-Dec., 1977. They consisted of 40 males (length 26.2-95.5 cm) and 32 females (length 27.2-99.0 cm). Samples, after wet digestion with mixed acids, were analysed for Hg by cold-vapour flameless AAS, for Cd by a graphite furnace method and for the other metals by flame AAS. Concn. of Hg, Zn, Fe, Cd and Cu in *M. manazo* were in the ranges 0.009-1.07, 1.9-4.5, 1.0-5.8, 0.001-0.014 and 0.14-0.53 µg/g wet wt. for muscle and in the ranges 0.005-0.628, 4.6-14.3, 25-214, 0.04-3.3, and 0.9-3.8 µg/g wet wt. for liver, resp. Hg concn. in muscle was higher than in liver tissue, but other metals were highly accumulated in liver. Hg concn. in muscle was found to increase in proportion to total length and age. AS

24

Cadmium content of shellfish of the South Carolina fishery.

Koli, A. K.; Felix, K. L.; Whitmore, R.

Abstracts of Papers, American Chemical Society 177 (1) ENVR 238 (1979) [En] [S. Carolina State Coll., Orangeburg, South Carolina 29117, USA]

Accumulation of Cd by shellfish depends on size, age, sp., sex and environment of shellfish. The present detn. of background Cd metal levels in marine fauna was part of a wider environmental baseline investigation carried out in some selected shellfish spp. of South Carolina Fisheries. Samples of shellfish from the Atlantic Coast of South Carolina were collected. The fish collected were oysters, clams, crabs, shrimps and scallops. Shellfish were dissected and pieces of edible muscle tissue were placed in flasks. The sample flasks were digested in a constant temp. shaking water bath at 58°C until solution was clear, in reagent-grade HNO₃/H₂SO₄. The flasks were then analysed for Cd metal content by flame AAS using a Perkin-Elmer Model 306 spectrophotometer. A significant finding of this report is that shellfish contain more Cd levels than other saltwater bony fish. In spp. for which fish of widely differing wts. were analysed, larger shellfish had higher Cd content than smaller shellfish of the same sp. AS

25

Plants which accumulate metals.

Farago, M. E.

Abstracts of Papers, American Chemical Society 177 (1) INOR 333 (1979) [En] [Dep. of Chem., Bedford Coll., Univ. of London, Regent's Park, London NW1 4NS, UK]

Conditions of high mineralization produce plant communities which are able to thrive because of their tolerance to conditions which are usually highly toxic. Some of these metal tolerant spp. accumulate large quantities of specific metals in their tissues, and this type of plant may have great economic and amenity importance. If used as foods or fodder they present a possible point of entry of toxic metals, e.g. Hg and Cd, into the food chain. The environmental effects of mineralization upon plants near old mine sites in the UK and over undisturbed sites in Australia are examined. Some results of studies of accumulator plants are presented. The location and chemical form of the metal within the plant and the mechanism of specificity are discussed. AS

26

[1979 standard values for lead, cadmium and mercury in and on foods.] Richtwerte '79 für Blei, Cadmium und Quecksilber in und auf Lebensmitteln.

Anon.

Bundesgesundheitsblatt 22 (15) 282-283 (1979) [1 ref. De]

Figures are presented relating the standard values for heavy metals in a range of foods and beverages, including: milk, various meats, fruits and vegetables, drinking water and wine. The tables also show sample size, range of analytical values, mean values and %

sample less than the standard level for detn. of each of the metals in the various foodstuffs. [See FSTA (1979) 11 3U124 for 1976 standards.] JRR

27

[Changes in the content of lead, cadmium and mercury in vegetables as a result of domestic preparation.] Veränderung der Gehalte von Blei, Cadmium und Quecksilber in Gemüsen bei der haushaltsüblichen Zubereitung. Schelenz, R.; Boppel, B.; Zacharias, R.; Fischer, E. *Berichte der Bundesforschungsanstalt für Ernährung* No. 1, 94pp. (1979) [28 ref. De, en] [Zentrallab. für Isotopentechnik, Bundesforschungsanstalt für Ernährung, Karlsruhe, Federal Republic of Germany]

186 samples of various vegetables (cauliflower, kohlrabi, French beans, carrots, Brussels sprouts, potatoes, and savoy cabbage) were used in a study on effects of domestic-style processing on contents of Hg, Pb and Cd. Hg was determined by neutron activation analysis; Pb and Cd were determined by AAS. Effects of trimming, washing, peeling (as appropriate) and boiling or steaming on heavy metal concn. were studied. Numerous tables of data are given showing Pb, Hg and Cd concn. in the vegetables at each stage of processing, in the water and NaCl used in cooking, and in the peeling wastes, etc. The results are discussed in detail. Overall, trimming, washing and peeling reduced Pb and Hg concn. of the vegetables by approx. 50%; little further reduction in concn. of these 2 metals occurred during cooking. Cd concn. decreased by only approx. 7% as a result of domestic-style preparation. No significant effect of the added NaCl on heavy metal concn. is likely; the water used for cooking of vegetables might influence Hg concn., but is unlikely to influence Pb or Cd concn. AJDW

28

Trace metal contamination of soils and vegetables in Shipham, Somerset.

Davies, B. E.; Ginnever, R. C.

Journal of Agricultural Science, UK 93 (3) 753-756 (1979) [5 ref. En] [Dep. of Geography, Univ. Coll. of Wales, Aberystwyth, Dyfed, SY23 3DB, UK]

Samples of top soil and vegetables (potatoes, Brussels sprouts and parsnips or swedes) were collected from 7 gardens in Shipham (an area mined in the past for Zn) and from a control garden in Compton Dundon, Somerset, and analysed for trace metal content (Pb, Zn, Cu, Cd and Ag). Results are shown in tables. The mean soil Pb content in Shipham was $30 \times$ that of the control garden, and the corresponding ratios for potatoes, root crops and sprouts were 2.2, 2.3 and 8.2 resp.; corresponding figures for Cd were $35 \times$, 5.3, 3.4 and 6.6. For Pb, Zn and Cd their availability increased in the order potatoes < roots < sprouts whereas the reverse order was observed for Cu. Ag normally occurs in plants at concn. below the detection limit of flame absorption spectrophotometry, but in several cases the concn. in Brussels sprouts were high, and similar to Cd. AL

29

[Uptake of lead, cadmium and mercury by cultivated mushrooms.] Zur Blei-, Cadmium- und Quecksilber-Aufnahme in Kulturchampignons.

Enke, M.; Roschig, M.; Matschiner, H.; Achtzehn, M. A. *Nahrung* 23 (7) 731-737 (1979) [15 ref. De, en, ru] [Bezirks-Hygieneinspektion & -inst., Halle, German Democratic Republic]

Studies on uptake of Pb, Cd and Hg by cultivated mushrooms (*Agaricus bisporus*) grown in media enriched with these heavy metals are described. Pb content of the mushrooms was not influenced by the Pb content of the growth medium; it is therefore concluded that Pb in mushrooms is largely attributable to air pollution. Accumulation of Cd and Hg by the mushrooms increased with increasing concn. of these elements in the growth medium, the correlations between concn. in mushrooms and in the corresponding growth medium being significant. The Cd concn. of the mushrooms decreased in successive harvests from the same batch of growth medium; this effect was not observed for Hg. IN

30

Cadmium-ozone interactions in cress, tomato and bean in relation to phytotoxicity, growth, and mineral and water contents.

Czuba, M.

Dissertation Abstracts International, B 39 (1) 18-19 (1978) [En] [Univ. of Guelph, Guelph, Ontario, Canada]

Studies were made of the effects of Cd, O₃ and Cd + O₃ treatments on total injury, water content, growth and mineral balance of cress, lettuce, tomato and bean plants. The studies involved comparisons of Cd and O₃ in factorial combinations, of species variability, of Cd forms, of Zn and Ca counter-treatments, and of separate plant parts before, during and after O₃ exposure. Cd added to the rooting medium produced significant decreases in the contents of water and pigments and increases in injury after O₃ exposure, compared with separate Cd or O₃ treatment; the chlorophyll b content decreased more than that of chlorophyll a and carotenoids in cress and lettuce. Red pigments induced by Cd were 'bleached' by O₃. High Cd concn. in the rooting medium resulted in increased leaf Cd content and thereby increased the sensitivity of leaves to low O₃ concn. Older leaves, which contained more Cd and water than younger leaves, were more severely injured than younger leaves after O₃ exposure. JA

31

Yield, cadmium uptake, and mineral nutrition of lettuce and chard grown on acid and calcareous soils treated with a cadmium-enriched sewage sludge. Mahler, R. J.

Dissertation Abstracts International, B 38 (12) 5688-5689: Order no. 78-08287, 110pp. (1978) [En] [Univ. of California, Riverside, California 92502, USA]

8 soils with pH values ranging from 4.8 to 7.8 were amended at a 1% rate with a municipal sewage sludge

containing varying amounts of CdSO_4 ; the resultant Cd concn. in the soils ranged from 0.0 to 320 $\mu\text{g/g}$. Lettuce (*Lactuca sativa* var. *longifolia*) and Swiss chard (*Beta vulgaris* var. *cicla*) were grown to maturity in the treated soils to observe the interactive effects of soil pH and Cd on plant yield and on Cd uptake and accumulation. Increasing Cd addition to the soils resulted in increased Cd uptake by the plants, the greatest accumulation occurring in plants grown in acid soils. Chard accumulated significantly higher concn. of Cd than lettuce. Plant tissue analysis indicated that the reduced yields associated with Cd-treated soils are the result of Cd toxicity and not the result of Cd treatment altering the availability of Zn, Mn, Fe, P, Ca or Mg. JA

32

[Studies on the accumulation of trace elements in fish. IV. Accumulation of selenium and mercury in various tissues of tuna.]

Nishigaki, S.; Tamura, Y.; Maki, T.; Shimamura, Y.; Naoi, Y.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 28 (1) 140-144 (1977) [13 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo, 160 Japan]

Mean concn. and ranges of muscle and internal organs contents of Se, Hg, As, Cd, Pb, Cu, Zn are tabulated (in En) for sweet smelt, trout, rainbow trout and pond smelt and for 2-3 locations in Japan. Se concn. were not related to size or sp. of fish or location. Tissue distributions, including white and dark muscle, of the same elements are tabulated for catfish, carp and crucian carp. Contents of Se and Hg in catfish were (p.p.m.): white muscle 0.11-0.15, 0.21-0.44; dark muscle 0.11, 0.22-0.43, resp. Overall mean Se content in muscle was 0.16 ± 0.04 p.p.m. Accumulation of Mg increased with growth; no other pattern of accumulation was discernible. [From En summ.] [See FSTA (1977) 9 2R56 for part III.] DIH

33

[Contents of trace elements in shells of short-necked clam in Tokyo Bay.]

Yasuno, T.; Ogino, S.; Ono, A.; Ohata, T.; Endo, F.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 28 (1) 156-162 (1977) [16 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo, 160 Japan]

Trace elements were determined by AAS, in 22 samples of short-necked clam taken from 5 sampling locations in Tokyo Bay, during May-Sept. AAS conditions and results for each sample are tabulated in En. Mean contents were (p.p.m.): As 0.085, Cd 0.09, Pb 0.18, Cu 1.24, Cr 0.022, Zn 3.73, Fe 32.5, Mn 16.2, Mg 157, Sr 1496 and total Hg 0.034. Significant differences between sampling locations were noted for Pb, Cu, Zn, Fe and Sr. [From En summ.] DIH

34

[Study of trace elements in marine fish. III. Distribution of arsenic and heavy metals in seabass tissue.]

Yasuda, K.; Katsuki, Y.; Ueda, K.; Noai, Y.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 28 (1) 121-126 (1977) [24 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo, 160 Japan]

39 seabass 42-70 cm in length were caught at various locations off Japan and contents of heavy metals in muscle and internal organs were determined. Mean concn. (p.p.m. wet basis) in muscles were: methylmercury 0.23, total Hg 0.28, As 0.41, Cd <0.01, Pb 0.04, Zn 4.5, Cu 0.25, Co 0.02, Cr 0.02 and Mn 0.04. Cd concn. was lower, and Pb higher, than that in bonito tissue [see Part II, FSTA (1977) 9 2R55]. Hg tended to accumulate in muscle rather than viscera. A separate study of young fish showed that total Hg concn. in muscle increased with body length, from 0.01 to 0.03 p.p.m. with corresponding increase in length from 5-9 cm to 34 cm. As concn. was unaffected by length. There were no significant differences among the 39 mature seabass in heavy metal content with regard to location. [From En summ.] DIH

35

Biochemistry of selected heavy metals in Western Port, Victoria, and use of invertebrates as indicators with emphasis on *Mytilus edulis* planulatus.

Harris, J. E.; Fabris, G. J.; Statham, P. J.; Tawfik, F. *Australian Journal of Marine and Freshwater Research* 30 (2) 159-178 (1979) [36 ref. En] [Marine Chem. Unit, Min. for Conservation, 7b Parliament Place, E. Melbourne, Victoria 3002, Australia]

The relations of Cd, Cu, Fe, Mn, Pb and Zn concn. in sediments, seagrasses and several invertebrates with the geological source areas in the W. Port catchment were examined and shown with the aid of maps. Highest Cd, Fe and Pb levels were in mussels on the E. side. Concn. in a composite sample from the lower N.W. arm segment were 0.132, 5.22, 39.2, 0.881, 0.302 and 26.1 $\mu\text{g/g}$ fresh wt. resp. Freeze drying reduced Fe concn. by 6.9% (to 36.5 mg/g fresh wt. equivalent) and Pb concn. by 3.7% (to 0.189), but had no significant effect on the other metals. Cd, Zn and water contents increased linearly with shell length, Mn concn. decreased, Pb and Fe data could not be fitted with a linear equation. Concn. of Cd, Fe and Pb appeared to be directly related to detritus derived from seagrass meadows, Zn concn. to both detritus and man's activities. RM

36

[The effects of increasing Cd doses on the performance of fattening pigs and on the carry-over in several tissues. II. Cd residues in various tissues.]

Untersuchungen über den Einfluss steigender Cadmiumzulagen auf die Entwicklung von Mastschweinen und auf die Rückstandsbildung in

verschiedenen Geweben. II. Cadmiumrückstände in verschiedenen Geweben.

Vemmer, H.; Petersen, U.

Landwirtschaftliche Forschung 32 (3) 303-315 (1979) [13 ref. De, en] [Inst. für Tierernährung, Bundesforschungsanstalt für Landwirtschaft, Braunschweig-Völkenrode, Federal Republic of Germany]

100 fattening pigs given Cd supplement of 0.03-123 mg/kg were slaughtered at live wt. of 100 kg. Cd contents were determined in the renal cortex, liver, muscle (*M. longissimus dorsi*), subcutaneous fat, rib, and incisor tooth. Results are shown graphically and in tables. At Cd concn. in the diet of 0.11 (no supplement) to 0.28 mg/kg the renal cortex contained approx. 1 mg Cd/kg wet wt. and there was no correlation with dietary Cd; at 0.45-15.0 mg Cd/kg, Cd increased linearly with the dose, at > 15 mg/kg Cd in renal cortex increased more slowly than increase in dose, to a max. of 1550 mg/kg DM. Cd contents in the liver showed a similar dose relation, at a lower concn. (max. 271 mg/kg). In bone (rib), muscle and subcutaneous fat, measurable increase in Cd was found at dietary Cd > 4 mg/kg (max. 2.0, 0.71 and 0.26 mg/kg DM resp.). The permitted Cd level in complete feeds for fattening pigs is discussed. [See preceding abstr. for part I.] RM

37

[Toxic metals in the human environment - the role of foods of animal origin.] Toxische Metalle in der Umwelt des Menschen - die Rolle von Nahrungsmitteln tierischer Herkunft. [Review]

Käferstein, F. K.; Klein, H.; Lorenz, H.; Müller, J.; Schmidt, E.; Wosing-Narr, V.

Tierärztliche Umschau 34 (7) 468, 471-473 (1979) [many ref. De, en] [ZEBS, Bundesgesundheitsamt, Postfach, D-1000 Berlin 33]

This lecture reviews the importance of toxic metals in the industrial society, sources and pathways of contamination of plant and animal foods, effects of food processing, probable daily intake in the Federal Republic of Germany and WHO provisional tolerable weekly intakes of Pb, Cd and Hg. RM

38

[Contamination of foods and feeds from selected areas of the Erfurt district with lead and cadmium. I. Determination of lead and cadmium in vegetable material by inverse voltammetry.]

Untersuchungen zur Kontamination von Lebens- und Futtermitteln ausgewählter Gebiete des Bezirkes Erfurt mit Blei und Cadmium. I. Bestimmung von Blei und Cadmium in pflanzlichem Material mittels Inversvoltammetrie. Engst, R.; Lauterbach, K.; Beckmann, G.; König, R. *Nahrung* 23 (7) 739-747 (1979) [31 ref. De, en, ru] [Zentralinst. für Ernährung, Potsdam-Rehbrücke, German Democratic Republic]

A procedure is described for detn. of Pb and Cd in foods and feeds of vegetable origin, based on wet digestion of the sample with HNO₃ vapour followed by HClO₃, then detn. of Pb and Cd by inverse voltammetry using a Hg-coated stationary carbon electrode. Detection limit was 0.66 ng/ml for Pb, 0.3 ng/ml for Cd.

When the method was applied to samples, recoveries were 102.0 ± 10.8% for Pb, and 101.6 ± 11.4% for Cd. With careful mixing of the material under test, this procedure permits the use of small samples. Advantages of the wet digestion procedure used include simplicity, rapidity and low likelihood of contamination of the sample. IN

39

Cadmium and the food chain. [Review]

Dorn, C. R.

Cornell Veterinarian 69 (4) 323-344 (1979) [96 ref. En] [Dep. of Vet. Preventive Med., Ohio State Univ., Columbus, Ohio 43210, USA]

The purpose of this review is to present current scientific knowledge on Cd sources, levels in animal feeds, and intake, absorption and distribution in the body of food-producing animals; only those sources are considered which may be involved in the exposure of livestock or in contamination of animal feed products. The review contains the following sections: sources of Cd (air, water, soil); levels in animal feed (forage crops, other primary feed components, mineral supplements, bone meal supplements, recycled feedlot wastes, sewage sludge); uptake, absorption and distribution in the body (uptake and absorption; transport, distribution and excretion; milk, meat and other tissue levels); Cd absorption by avian species, distribution, excretion and transfer into eggs; effect on the immune system; problems in evaluating the current status of Cd (analytical methods, fate of different Cd complexes in different spp., route and frequency of exposure, interactions, future contamination levels); and food standards for Cd. JA

40

[Toxicological study of synthetic packaging materials used in the food industry.]

Karger-Kucsis, J.

Anyagmozgatas Csomagolas 26 (3) 79-82 (1979) [16 ref. Hu]

Synthetic packaging materials used in the food industry should be examined for the presence of toxic substances which have a tendency to accumulate in the human body (e.g. heavy metals such as Cd and Pb and their compounds) and for carcinogenic properties. Since the human body may only tolerate a daily uptake of 400 µg Pb and 60 µg Cd the daily amounts of Pb and Cd originating from packaging materials should not be higher than 20 and 3 µg, resp. Although vinyl chloride, vinylidene chloride, acetonitrile and epichlorhydrin monomers have been shown to be carcinogenic in animal experiments, carcinogenicity can be significantly reduced by improved technology. The polystyrene contamination of foodstuffs from packaging materials is estimated to be 0.05-0.4 p.p.m., but its carcinogenic properties are not confirmed. There is no experimental data on the migration of polyolefins into food, but it is estimated to be in the parts/billion range. Because ethylene oligomers are almost indistinguishable from polyethylene waxes used for the treatment of paper-based packaging materials, the proposed total polymer and oligomer migration of 10 mg/dm² may limit the use of polyolefins as packaging materials. ESK

41

[Evaluation of the use of cadmium pigments for colouring plastics intended for food-contact applications.] Beitrag zur Beurteilung des Einsatzes von Cadmiumpigmenten bei der Einfärbung von Plasten für Bedarfsgegenstände.

Hoppe, H.; Romminger, K.

Nahrung 23 (8) 785-795 (1979) [10 ref. De, en, ru]
[Zentrale Lebensmittelhygienische Untersuchungsstelle, Berlin]

The use of Cd pigments for colouring of food-contact plastics is discussed, with reference to the danger of migration of Cd into foods. Migration trials were conducted with samples of various plastics (low- and high-density polyethylene, polyamide-6 and polystyrene), coloured with various Cd pigments and held in contact with 3% acetic acid solution for 10 days at 22° or 45°C with or without illumination. Tables of results are given. On the basis of the results, it is concluded that polyethylene for food contact applications may, under certain conditions, be coloured with Cd pigments; the same is probably true of polystyrene and polypropylene. Cd pigment content in the plastics should not exceed 0.5% as Cd. Continuance of the present max. tolerance for 0.5% Cd, soluble in 0.1N HCl, in the pigment is recommended. Use of Cd pigments for colouring of food-contact polyamide items is stated to be undesirable; also, bottles for vinegar should not be made from any plastics material coloured with Cd pigments. Recommended conditions for testing of migration of Cd are: use of 3% acetic acid; contact time 10 days, at $22 \pm 2^\circ\text{C}$; contact area 100 cm² plastics/100 ml acetic acid; and illumination at 100 lux. IN

42

[Mercury and cadmium concentrations of brown rice produced in Korea.]

Yang, J. S.; Lee, S. R.; Rho, C. S.

Korean Journal of Food Science and Technology 11 (3) 176-181 (1979) [28 ref. Ko, en] [Environment Dep., Korea Atomic Energy Res. Inst., Seoul, S. Korea]

Hg and Cd concn. were analysed for 112 brown rice samples collected from various production areas of Korea in 1976 and the results obtained are tabulated. Hg concn. were in the range of non-detectable to 0.310 p.p.m., with an average of 0.053 p.p.m. 2 samples from Kimpo area had Hg concn. 5-6 times higher than the average value. Cd concn. were in the range of trace to 0.029 p.p.m. with an average of 0.021 p.p.m. No specific site was found to be seriously contaminated by Cd as far as the present survey was concerned. AS

43

[Heavy metal contents in deep-sea fishes.]

Kobayashi, R.; Hirata, E.; Shiomi, K.; Yamanaka, H.; Kikuchi, T.

Bulletin of the Japanese Society of Scientific Fisheries [Nihon Suisan Gakkai-shi] 45 (4) 493-497 (1979) [16 ref. Ja, en] [Lab. of Food Hygienic Chem., Tokyo Univ. of Fisheries, Konan, Minato-ku, Tokyo 108, Japan]

In order to find whether deep-sea fish were safe to eat, heavy metal contents were determined in the muscles of 16 spp. caught off New Zealand and Patagonia. Heavy metal contents (p.p.m.) were as follows: 0.04-0.46 total Hg; 0.02-0.44 methylmercury; 0.08-0.46 Se; trace-0.03 Cd; 4.3-10.9 Zn; trace-0.53 Pb; and 0.12-9.99 As. The Hg contents of dory, *Cyttoidopus* sp. and tarakihi, *Cheilodactylus macropterus*, exceeded the temporary regulatory level of Hg in fish and shellfish. Contents of Se, Cd, Zn, and As in muscles of deep-sea fish were about the same as those of commercial fish, but Pb was present at somewhat higher levels in muscles of deep-sea fish. In dory muscle the amounts of total Hg and methylmercury were found to be proportional to body wt. There exists a significant correlation between the depth at which fish were caught and total Hg content, i.e. the deeper the fish live, the higher the total Hg found. AS

44

[Heavy metal contents in marine organisms from the by-catch of the Belgian inshore fishery.]

Clerck, R. de; Vanderstappen, R.; Vyncke, W.; Hoeyweghen, P. van

Revue de l'Agriculture 32 (3) 793-801 (1979) [24 ref. Fr, en] [Sta. de Peche Maritime, Ankerstraat 1, B-8400 Oostende, Belgium]

The Hg, Zn, Cu, Pb, Cd and Cr contents were determined in 16 spp. of the Belgian inshore fishery by-catch. Tabulated results showed high Hg concn. in flounder (*Platichthys flesus*, mean 0.52 mg/kg) and horse mackerel (*Trachurus trachurus*, mean 0.73 mg/kg) With a few exceptions the concn. of the other metals were quite normal and mostly similar to those found on the high seas. Mean Cd concn. in anchovy was 0.07 mg/kg, all others ≤ 0.02 mg/kg. The continued use of flounder and horse mackerel as indicators of Hg pollution is recommended. RM

45

Trace metal contamination of the rock scallop, *Hinnites giganteus*, near a large southern California municipal outfall.

Young, D. R.; Jan, T.-K.

Fishery Bulletin, National Oceanic and Atmospheric Administration 76 (4) 936-939 (1979) [12 ref. En] [S. California Coastal Water Res. Project, 1500 E. Imperial Highway, El Segundo, California 90245, USA]

Abnormal levels of Ag, Cd, Cr, Cu, Ni, Pb and Zn were found in 3 tissues of rock scallop (including the adductor muscle, prized as a delicacy), collected near the outfall of a municipal wastewater discharge from Los Angeles, California, USA. Levels found in 1974 and in 1976 were not significantly different, but were higher than those in control scallops collected near offshore islands. In adductor muscle, Cd (0.92 mg/kg), Cr (0.33 mg/kg), and Cu (0.32 mg/kg) levels, on a wet wt. basis, were significantly higher than controls ($P < 0.05$). JRR

46

Heavy metals in the native oyster (*Ostrea angasi*) and mussel (*Mytilus edulis planulatus*) from Port Davey, South-western Tasmania.

Thomson, J. D.

Australian Journal of Marine and Freshwater Research 30 (3) 421-424 (1979) [13 ref. En] [Tasmanian Fisheries Development Authority, Crayfish Point, Tarooma, Tasmania 7006, Australia]

Oysters and mussels were sampled from Port Davey in winter 1975 and summer and winter 1978. Mean metal concn. in oysters were (mg/kg wet wt.): Zn 954 (Jan. 1978) - 1662, Cd 0.15-0.25, Cu 4.7-20.6 (June 1975), and Pb 0.2-2.0 (June 1975); in mussels Zn 22.1-26.7, Cd 0.16-0.22, Cu 0.8-19.6 (June 1975) and Pb 0.3-4.1 (June 1975). The permissible concn. for Zn (1000 mg/kg) provisionally recommended by the National Health and Medical Research Council was exceeded in oysters, and the standard for Pb (2.0 mg/kg) in both mussels and oysters in the 1975 samples. As Port Davey is isolated and virtually uninhabited the metals derive from natural sources. Any recommended permissible concn. for Zn in shellfish should take cognizance of natural levels in isolated areas, and recognise that the Zn:Cd ratio in oysters is not fixed. RM

47

[Lead, cadmium and arsenic contents in meat and organ samples of game from areas with varying heavy metal contamination.] Blei-, Cadmium- und Arsengehalte in Fleisch und Organproben von Wild aus unterschiedlich schadbelasteten Regionen.

Holm, J.

Fleischwirtschaft 59 (9) 1345-1349 (1979) [many ref. De, en] [Staatliches Veterinäruntersuchungsamt Braunschweig, Dresdenstrasse 6, 3300 Braunschweig, Federal Republic of Germany]

Pb, Cd and As contents were determined in the liver and kidneys of hares, pheasants, ducks, roe deer and red deer and in the meat of hoofed animals (deer, wild sows and boars). Results are tabulated with regard to browsing conditions, i.e. animals from agricultural areas, browsing in fields, woodlands, near a town, or in an immission area. Only slight metal contamination was observed in the skeletal muscle of hoofed game (Pb 0.04-0.07, Cd 0.005-0.03, As 0.005-0.010 p.p.m., on fresh wt. basis), but fairly heavy Pb and Cd contamination in the organs (mean Pb 1.5-1.8 p.p.m. in hare liver, 1 p.p.m. in hare kidneys, 0.25-0.40 p.p.m. in liver and kidneys of hoofed game). Higher Pb contents were found in red deer from the Harz mountains (0.51-1.94 p.p.m. in liver, 0.75-2.45 p.p.m. in kidneys). The heaviest contaminations were observed in the organs of animals from an immission area (e.g. max. Pb contents in hare liver 21.22 p.p.m., in duck liver 7.25, in roe deer liver 3.69; corresponding levels in kidneys 10.07, 33.04 and 10.31 p.p.m.). Cd contents in the kidneys were affected mainly by the age of the animals and varied between 0.5 and 12.0 p.p.m., in livers between 0.05 and 1.3 p.p.m. except for the immission area (max. 16.39 in livers, 121.05 in kidneys). As contents were 0.005 to 0.010 p.p.m., and presented no problems. It is suggested that game kidneys be discarded, and care exerted in marketing game from immission areas. [From En summ.] RM

48

[Toxic trace elements in foods.] Toxische Spurenelemente in Lebensmitteln.

Treptow, H.; Bielig, H. J.

Verbraucherdienst, B 23 (7) 163-166 (1978) [De] [Inst. für Lebensmitteltech., Tech. Univ., Berlin]

A total of 164 samples of 22 types of vegetables (not including root vegetables) and 88 samples of 10 types of fruit were analysed for As, Cd, Pb and Hg by flameless AAS. As concn. in vegetables ranged from 0.016 mg/kg for green beans to 0.50 mg/kg for spinach; values for fruit ranged from 0.033 mg/kg (various types) to 0.19 mg/kg for apples. Pb concn. in vegetables were < 0.3 mg/kg, except for parsley (≤ 1.02 mg/kg) and spinach (≤ 0.93 mg/kg). Pb concn. in fruit were < 0.3 mg/kg except for 2 apple samples which contained ≤ 0.433 mg/kg. The highest Cd concn. in vegetables were recorded for chives (0.082 mg/kg), spinach (0.069 mg/kg) and parsley (0.058 mg/kg); all fruit contained ≤ 0.03 mg Cd/kg, except for 1 apple sample with 0.116 mg/kg. All Hg concn. were below the recommended limit of 50 parts/billion. Heavy metal levels in fungi are briefly considered (no experimental data given). The role and activities of the Central Institution for Recording and Evaluation of Environmental Chemicals in the Federal Republic of Germany are briefly discussed. AJDW

49

Trace metal content of rapeseed meals, oils and seeds.

Elson, C. M.; Hynes, D. L.; MacNeil, P. A.

Journal of the American Oil Chemists' Society 56 (12) 998-999 (1979) [6 ref. En] [Dep. of Chem., Saint Mary's Univ., Halifax, Nova Scotia, Canada B3H 3C3]

The concn. of Pb, Cu, Cd and Zn as determined by anodic stripping voltammetry and AAS in a series of rapeseed oils, meals, and seeds is reported. The metal content of rapeseed seeds is not influenced by growing area; however, the var. appears to affect the metal levels. In general, meals contain twice the heavy metal burden of the seeds. The partitioning of metals between meals and oils heavily favours the meals except for Pb where the distribution is approx. 2 to 1. AS

50

Systematic investigations of the heavy metal pollution (Cd, Pb, Cu, Zn, Cr, Ba) of drinking water using atomic absorption spectrometric methods.

Bozsai, G.; Csanady, M.

Zeitschrift für Analytische Chemie 297 (5) 370-373 (1979) [21 ref. En, de] [Nat. Inst. of Public Health, POB 64, H-1966 Budapest, Hungary]

140 samples of drinking water were collected at a water treatment plant and from domestic water supply. Samples were analysed for heavy metal pollution by electrothermal AAS directly, and after preconcn. by chelate extraction with ammonium tetramethylene dithiocarbamate methyl isobutyl ketone. Tabulated results showed fairly good agreement between the 2 methods. Filterable residues from tap water and sediments of reservoirs in the distribution system were analysed by flame AAS after acid digestion. Results are discussed in relation to Hungarian Drinking Water

Standards. No significant heavy metal pollution originating from surface water and no significant dissolution from pipe materials was observed. Heavy metals were adsorbed on the surface of residue materials and were concentrated in the sediments of the reservoirs. RM

51

[Studies on residues of added metals in grape must after fermentation.] Untersuchungen zum Verbleib von Schwermetallen, die Traubenmost zugesetzt wurden, nach Ablauf der Gärung.

Mohr, H. D.

Weinberg und Keller 26 (7) 277-288 (1979) [11 ref. De, en] [Biol. Bundesanstalt für Land- & Forstwirtschaft, Inst. für Pflanzenschutz im Weinbau, Bernkastel-Kues/Mosel, Federal Republic of Germany]

In fermentation tests with artificially contaminated Riesling musts of 1976 and 1978, the effects of heavy metals on fermentation, and their elimination were investigated. The following results were obtained: inhibition of fermentation only occurred at fairly high concn., the toxicity increasing in the following order: Zn, Co, Cr⁶⁺, Ti, V (≤ 500 p.p.m.) < Pb (200-400 p.p.m.) < Ni, Cr³⁺ (250 p.p.m.) < Se (50-100 p.p.m.) < Cu (25-50 p.p.m.) < As (10-25 p.p.m.) < Hg (5-10 p.p.m.) < Cd (2-5 p.p.m.); the rate of elimination after fermentation increased as follows: Zn, Co, Ni, Cr³⁺ (about 0%) < As (12-33%) < Cd (34-79%) < Pb (51-90%) < Cu, Hg, Se (86-100%). The formation of insoluble metal sulphides was a decisive factor for the elimination of metals from musts. AS

52

[Effect of sewage sludge compost on heavy metal contents of vineyard soils, grapevines and must.] Einfluss von Müll-Klärschlammkompost auf den Schwermetallgehalt von Weinbergsboden, Reborganen und Most.

Mohr, H. D.

Weinberg und Keller 26 (8) 333-344 (1979) [22 ref. De, en] [Biol. Bundesanstalt für Land- & Forstwirtschaft, Inst. für Pflanzenschutz im Weinbau, Bernkastel-Kues/Mosel, Federal Republic of Germany]

The enrichment of vineyard soils in heavy metals (Zn, Cu, Pb, Cd, Co, Ni, Cr) by sewage compost and sewage sludge compost, and their uptake by grapevines and appearance in musts was studied in field and pot experiments. Tabulated results showed no significant increases in metal content of grapes and musts after application of up to 300 t/ha. RM

53

[Cadmium content of vegetable foods in the effective range of a lead smelting plant.] Cadmiumgehalt pflanzlicher Nahrungsmittel im Wirkungsbereich einer Bleihütte.

Auermann, E.; Dässler, H.-G.; Cumbrowski, J.; Kneuer, M.; Jacobi, J.; Kühn, H.

Nahrung 23 (9/10) 875-890 (1979) [32 ref. De, en, ru] [Bezirks-Hygiene Inst., Karl-Marx-Stadt, German Democratic Republic]

Studies were conducted on Cd concn. in 27 types of

vegetables and 11 types of fruit grown at distances of 375-1000 m from a Pb smelting plant. Soil, dust and water samples were also studied. Tables of results are given. Cd levels in produce grown in the vicinity of the Pb smelter were compared with those grown in non-polluted regions. Cd levels in vegetables grown near the smelter were 2-85 times greater than those in fruit and vegetables grown in non-polluted regions. Mean Cd concn. in vegetables from the polluted region ranged from 0.2 p.p.m. (potatoes) to 25.5 p.p.m. (cress); Cd concn. in fruit from the polluted region ranged from 0.09 p.p.m. (apples) to 1.71 p.p.m. (strawberries). Drinking water contained 0.009 p.p.m. Cd. Human uptake of Cd from fruit, vegetables and drinking water is discussed. IN

54

[The carry-over of toxic elements into the meat of farm animals.] Zum Carry over von toxischen Elementen in das Fleisch von Nutztieren.

Hecht, H.

Fleischwirtschaft 59 (11) 1621, 1624, 1626, 1628-1629; 1693 (1979) [17 ref. De, en] [Bundesanstalt für Fleischforschung, 8650 Kulmbach, Federal Republic of Germany]

This lecture discusses the carry-over or transfer of toxic substances from the feed to foods of animal origin, the aims and methods used to study carry-over of toxic metals (mainly Pb and Cd), and some results of Pb and Cd detn. in the meat, liver and kidneys of beef, pork, lamb, turkey, deer and wild rabbit from metal-polluted and unpolluted areas of Germany. Tabulated results show max. Pb levels of 57 parts/billion (p.p.b.) fresh wt. basis in the meat of domestic animals, 607 p.p.b. in rabbit meat with much higher levels in liver (max. 1510 p.p.b. in lamb and 24 000 p.p.b. in rabbit from polluted area) and in kidneys (804 p.p.b. in lamb, 8353 p.p.b. in rabbit from polluted area); corresponding levels for Cd are max. 14.4 p.p.b. in pork, 17.6 in deer and 17.8 in rabbit meat, 307 p.p.b. in beef and 2950 in rabbit liver, 540 p.p.b. in pork and 23 100 in rabbit kidneys. Results show that toxic metal contents in most meats are considerably below the proposed max. tolerances of 300 p.p.b. for Pb, 100 p.p.b. for Cd, but excessive concn. occur in some offals as a result of carry-over from contaminated feed. RM

55

[Studies on residues in Austria. I. Lead, cadmium and chromium in beef from Upper Austria.]

Rückstandsuntersuchungen in Österreich. I. Untersuchungen über Blei-, Cadmium- und Chromgehalt in Rindfleisch aus Oberösterreich.

Ruttner, O.; Jarc, H.

Wiener Tierärztliche Monatsschrift 66 (8/9) 259-262 (1979) [16 ref. De, en] [Bundesanstalt für Virusseuchenbekämpfung bei Haustieren, Emil-Behringweg 3, A-1231 Vienna, Austria]

Samples from 180 cattle from Upper Austria were subjected to wet digestion with HNO₃, and examined for metal residues by flameless AAS. Tabulated results were as follows (p.p.m. on fresh wt., range and mean): Pb 0.09-1.03 and 0.31; Cd 0.01-0.20 and 0.05; Cr 0.05-0.25 and 0.11. Up to 63% of Pb contents, 26% of

Cd contents and 4% of Cr contents were above suggested max. values. RM

56

[Studies on residues in Austria. II. Heavy metals, pesticides and antibiotics residues in Carinthian cattle.] Rückstandsuntersuchungen in Österreich. II. Untersuchungen über Schwermetall-, Pestizid- und Antibiotikarückstände in Rindern aus Kärnten. Jarc, H.; Tratnig-Frankl, E.

Wiener Tierärztliche Monatsschrift 66 (10) 297-300 (1979) [21 ref. De, en] [Bundesanstalt für Virusseuchenbekämpfung bei Haustieren, Emil-Behringweg 3, A-1231 Vienna, Austria]

Meat, fat, liver, kidney and spleen from 23 animals were examined for Pb, Cd and Hg, pesticide and antibiotics residues by flameless AAS, GLC and the *Bacillus subtilis* test, resp. Tabulated results showed no antibiotics residues; no aldrin, heptachlor, endrin and PCNB; DDT and dieldrin in 1 fat and 1 liver sample each; and HCB, HCH and DDE at concn. far below legal tolerances (max. HCB 16.0, α -HCH 10.2, α -HCH 106.0, DDE 34.4, DDT 166.0, dieldrin 1.3 parts/billion, all in fat). Up to 83% of the Pb, 9% of Cd and no Hg concn. exceeded legal tolerances: 4% of liver samples had > 2 p.p.m. Pb, 52% > 0.5 p.p.m. Pb (max. 2.18); 13% of meat samples had > 0.5 p.p.m. and 74% > 0.2 p.p.m. Pb (max. 0.75); 4% of liver samples had > 0.5 p.p.m. Cd (max. 0.85); and 13% of meat samples contained > 0.1 p.p.m. Cd (max. 0.26). No sample had > 0.5 p.p.m. Hg. RM

57

[The supply of wild ruminants with major and trace elements. I. Cadmium content of winter grazing and the cadmium status of red deer, fallow deer, roe deer and mouflons.] Die Mengen- und Spurenelementversorgung der Wildwiederkäuer. I. Der Kadmiumgehalt der Winteräsung und der Kadmiumstatus des Rot-, Dam-, Reh- und Muffelwildes. Anke, M.; Grün, M.; Briedermann, L.; Missbach, K.; Hennig, A.; Kronemann, H.

Archiv für Tierernährung 29 (12) 829-844 (1979) [33 ref. De, en, ru] [Sektion Tierproduktion & Veterinärmed., Karl-Marx-Univ. Leipzig, DDR-69 Jena, German Democratic Republic]

This paper includes data for the Cd content of various tissues (kidneys, liver, ribs, brain) of red deer, fallow deer, roe deer and mouflon sheep, including data for animals from various regions of the German Democratic Republic, and also comparative data for Cd concn. in these organs of domestic sheep and cattle. There was a tendency for Cd concn. in organs of the wild ruminants to be appreciably higher than those in the corresponding organs of domestic ruminants. Max. Cd concn. recorded were: kidneys (roe deer) 14 mg/kg DM; liver (roe deer) 1.2 mg/kg DM; rib (roe deer) 0.30 mg/kg DM; and brain (mouflon) 0.24 mg/kg DM. It is recommended that kidneys and livers of wild ruminants should not be consumed. [See following abstr. for part II.] AJDW

58

Drinking water - determination of cadmium and cyanide contents.

Oman, Ministry of Commerce & Industry
Omanian Standard OS 16, 13pp. (1979) [En, Ar]

This standard specifies a dithizone method for detn. of Cd in drinking water. A list of Omani standards relating to drinking water is appended. KME

59

Determination of heavy metals in sea water and marine organisms by flameless atomic absorption spectrophotometry. IX. Determination of cadmium traces in biological materials by a simple extraction method.

Sperling, K.-R.

Zeitschrift für Analytische Chemie 299 (2) 103-107 (1979) [16 ref. En, de] [Biol. Anstalt Helgoland, Lab. Sülldorf, Wüstland 2, D-2000 Hamburg 55, Federal Republic of Germany]

This is part of a series describing methods for detn. of heavy metals in environmental samples by flameless AAS. Common to these methods are miniaturization and standardization, achieved by reduction of the number of steps, and simplification. The method described consists of acid digestion in 1.5 ml quartz, polyvinyl difluoride or polypropylene tubes, neutralization by excess saturated NaHCO_3 solution, extraction by a stable APDC (ammonium pyrrolidine dithiocarbamate) solution in carbon tetrachloride (stable for > 16 h at pH 1-8.5), and flameless AAS detn. Precision of the method is around 8.4% at concn. of $18.9 \text{ ng Cd g}^{-1}$; sensitivity is in the range of 1.2 ng Cd g^{-1} (and can be increased by a multi-stage extraction procedure). The method is sufficiently sensitive to allow Cd detn. in uncontaminated fish muscle. [See FSTA (1979) 11 8A564 for part VIII, and following abstr. for part XI.] RM

60

Determination of heavy metals in sea water and in marine organisms by flameless atomic absorption spectrophotometry. XI. Quality criteria for graphite tubes - a warning.

Sperling, K.-R.; Bahr, B.

Zeitschrift für Analytische Chemie 299 (3) 206-207 (1979) [5 ref. En] [Biol. Anstalt Helgoland, Lab. Sülldorf, Wüstland 2, D-2000 Hamburg 55, Federal Republic of Germany]

The effects of variable quality of the small graphite tubes of atomizers on the accuracy of Cd detn. are discussed. While the drying, atomization and cleaning steps are not critical, the charring step (before atomization) needs special care, requiring adjustment of the charring programme for each new charge of tubes. [See preceding abstr. for part IX.] RM

61

[Trace elements in nutrition of babies: arsenic, lead, cadmium.] Spurenelemente in der Kleinkindernahrung: Arsen, Blei, Cadmium.

Woidich, H.; Pfannhauser, W.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 170 (2) 95-98 (1980) [18 ref. De, en]
[Forschungsinstit. der Ernährungswirtschaft, Blasstrasse 29, A-1190, Vienna, Austria]

Dietary intake of As, Pb and Cd by babies in the 1st 12 months was studied. Tabulated data give contents of the 3 elements in milks, infant formulae and infant foods. Contents of As in dried milks, cereal formulae and foods in jars were ($\mu\text{g/kg}$): 10.0-13.4, 30.8 and 13.7-16.5, resp. Corresponding figures for Pb were (mg/kg) 0.12-0.15, 0.14-0.15, and 0.10-0.11 and for Cd were (mg/kg) 0.02-0.031, 0.032-0.041 and 0.0021-0.032. The relative excess of As in cereal foods was noted. Total intake of the trace elements was calculated for adults and babies on a $\mu\text{g/kg}$ body wt. basis; intake of Pb by babies was higher than that by adults. Regular control of infant foods for harmful trace elements is recommended. DIH

62

[The carry-over of Pb, Cd and Hg in chickens.] Zum carry-over Verhalten von Blei, Cadmium und Quecksilber bei Hühnern. [Review]
Nezel, K.

Mühle + Mischfüttertechnik 117 (3) 30-32 (1980)
[16 ref. De]

The distribution of Pb, Cd and Hg was determined in the tissues of broilers and hens after prolonged feeding with contaminated feeds, and also in eggs laid by the hens. The data are used to show the carry-over of these toxic metals into edible tissues and eggs. RM

63

Heavy metals in soil and cereals fertilized with sewage sludge. [Lecture]
Viitasalo, I.

Progress in Water Technology 10 (5) 309-316 (1978)
[4 ref. En] [Water Conservation Lab., City of Helsinki, Kylasaarenkatu 10, SF-00550 Helsinki 55, Finland]

Oats and barley were grown on plots fertilized with sewage sludge. Sludge was sprayed onto the plots during 1970-1975 with average doses of 8, 18 and 30 t TS/yr (i.e. cumulative levels over 6 yr of 48, 108 and 175 t TS resp.). Contents of Cu, Zn, Cd, Mn and Fe were measured in soil and seeds. Effect of sludge on uptake of heavy metals by oat and barley grain (pooled results) was negligible for Cu and Mn, slight for Zn and Fe, but high for Cd. Conc. in cereal seed (mg/kg TS) for cumulative sludge loads of 0, 48, 108 and 175 t were, resp.: Zn 38, 44, 48 and 49; Fe 53, 59, 58 and 96; and Cd 0.045, 0.084, 0.110 and 0.145. [See FSTA (1980) 12 7H1035.] AL

64

[Contents of Hg, Pb and Cd in salt- and fresh-water fishes.]

Bulinski, R.; Kot, A.; Kotulas, K.; Szydłowska, E.
Bromatologia i Chemia Toksykologiczna 12 (2) 169-173 (1979) [18 ref. Pl, en, ru] [Zakład Bromatologii Inst. Tech. i Analizy Farmaceutycznej Akad. Med., Lublin, Poland]

Mean Hg contents of 5-10 samples of 11 commercial frozen salt-water fish (determined by AAS) ranged from 0.008 to 0.023 mg/kg; Pb (colorimetry) contents ranged from 0.034 to 0.175 mg/kg; and Cd (colorimetry) from 0.032 to 0.059 mg/kg. Corresponding levels in 2-5 samples of 14 fresh-water fish were Hg 0.004-0.210, Pb 0.010-0.316 and Cd 0.018-0.094 mg/kg. HBr

65

[Lead and cadmium levels in livers of monogastric and polygastric animals, determined by AAS.]
Palacios Remondo, J.; Rairrez Diaz, S.
Revista de Agroquímica y Tecnología de Alimentos 19 (2) 279-282 (1979) [9 ref. Es, en] [Colegio Univ., Logrono, Spain]

Pb and Cd levels were determined by AAS in 30 samples each of beef, sheeps', goats' (polygastric) and pigs' (monogastric) liver obtained from the municipal abattoir. Tabulated results for the 4 spp. were, resp. (p.p.m.): Pb 0-8.30 (mean 2.55), 0-5.71 (1.31), 0-5.83 (0.83) and 0-4.80 (1.23); and Cd 0-0.30 (0.06), 0-0.52 (0.13), 0-1.11 (0.22), and 0-0.99 (0.14). RM

66

Cadmium and zinc in growing sheep fed silage corn grown on municipal sludge amended soil.

Heffron, C. L.; Reid, J. T.; Elfving, D. C.; Stoewsand, G. S.; Haschek, W. M.; Telford, J. N.; Furr, A. K.; Parkinson, T. F.; Bache, C. A.; Gutenmann, W. H.; Wszolek, P. C.; Lisk, D. J.
Journal of Agricultural and Food Chemistry 28 (1) 58-61 (1980) [37 ref. En] [Dep. of Anim. Sci., New York State Coll. of Vet. Med., Cornell Univ., Ithaca, New York 14853, USA]

3-month-old Dorset wethers were fed a diet containing ensiled corn for 274 days. For 1 group the corn had been grown on soil amended with municipal sewage sludge (280 t DM/ha). Contents of 43 elements in the soil, sludge, control corn and sludge-grown corn are tabulated. Contents of Cd in control and sludge-grown corn were 0.05 and 1.7 p.p.m. (DM) resp. Corresponding values for Zn content were 19 and 68 p.p.m. Contents of Cd in sheep tissues were significantly ($P < 0.05$) increased by feeding sludge-grown corn, e.g. (control levels given in parentheses, all p.p.m. DM): chuck muscle 0.01 (0.004), round muscle 0.01 (0.005), liver 5.8 (1.2), kidney 18.5 (5.4), heart 0.03 (0.01). Zn levels were not significantly affected by feeding treatment except in chuck muscle, which contained 151 p.p.m. (vs. 108 p.p.m. in controls, significant $P < 0.05$). Biochemical and histological examinations of sheep tissue are reported, and results are discussed from the aspect of toxic significance to humans. DIH

67

High temperature dry ashing of foods for atomic absorption spectrometric determination of lead, cadmium, and copper.

Feinberg, M.; Ducauze, C.
Analytical Chemistry 52 (1) 207-209 (1980) [8 ref. En]
[Lab. Central d'Hygiène Alimentaire, Min. de l'Agric., Services Vet., 43 Rue de Dantzig, 750 15 Paris, France]

High temp. dry ashing, i.e. (i) direct calcination at 750°C, was used for detn. of Pb, Cd and Cu in a large number of different foods, and compared with (ii) a method involving, as an initial step, classic dry ashing at 450°C, followed by attack with 3 ml HNO₃ and a second calcination at 750°C. 2 ml H₂SO₄ was used as ashing aid in both methods. Recoveries of added metals in some vegetables, dairy products, meats and fish are shown in a table. The 2 methods gave significantly different results; best recovery levels and relative s.d. were obtained with the quicker method (i), but the losses were about 10% and relative s.d. 10–12%. However, taking into consideration only 11 foods with a basic composition similar to bovine liver, the recoveries and relative s.d. were, resp., 95.6% and 6.2% for Pb, 95.3% and 4.7% for Cd, and 94.5% and 12.3% for Cu. Method (i) is thus particularly well suited for the detn. of heavy metals in protein-rich biological materials such as meat and fish. AL

68

[Analytical characteristics of the pressure digestion method for organic materials.] Analytische Eigenschaften des Druckaufschlusses organischer Substanzen.

Plesch, R.

Zeitschrift für Analytische Chemie 298 (5) 400–403 (1979) [3 ref. De, en] [Siemens AG, Bereich Mess- & Prozesstechnik, Postfach 211080, D-7500 Karlsruhe 21, Federal Republic of Germany]

In connection with the recently introduced pressure digestion method for organic materials [FSTA (1979) 11 11S1713], data for the recovery rates of 50–500 parts/billion Hg, As, Pb and Cd in beef and pork meat, liver and kidneys from 142 digestions were examined by photometry, AAS and X-ray fluorescence analysis (XFA). Statistical evaluation showed that the recovery rate at < 1 p.p.m. was independent of the concn. and of the matrix. The global mean recovery for each element was > 90%, allowing very wide application of the method (i.e. 90.2% for Hg, 90.7 for As, 94.8 for Pb, 93.8 for Cd). The mean s.d. for single results was 5.2% for AAS, 6.2 for XFA and 8.9 for photometry. RM

69

[Use of electronic data processing in evaluation of residue determinations as exemplified by heavy metals.] Einsatz der elektronischen Datenverarbeitung bei der Auswertung von Rückstandsuntersuchungen am Beispiel der Schwermetalle. [Lecture]

Schmidt, E. H. F.

Proceedings of the European Meeting of Meat Research Workers No. 24, L9:1–L9:7 (1978) [De, en, fr, ru] [Zentrale Erfassungs- & Bewertungsstelle für Umweltchemikalien, Bundesgesundheitsamt, Postfach, D-1000 Berlin 33]

The procedures for collection and evaluation of data on environmental chemicals and the software and hardware used for the purpose in the author's Establishment are described. The reports are available to the Federal and Länder Governments and, within data protection limitations, also to others interested. [See FSTA (1980) 12 8S1280.] SKK

70

Developments in land methods of wastewater treatment and utilisation. [Conference proceedings] Jenkins, S. H. (International Association on Water Pollution Research) (Editor)

Progress in Water Technology 11 (4/5) 1–532 (1979) [many ref. En]

This issue of the journal contains the proceedings of a conference on developments in land methods of wastewater treatment and utilization, held in Melbourne, Victoria, Australia on 23–27 Oct. 1978. Papers include: Environmental sources of heavy metals and their toxicity to man and animals, by E. J. Underwood (pp. 33–45, 45 ref.). Heavy plant [heavy metals] accumulation in soils irrigated by sewage and effect in the plant-animal system, by K. J. Evans, I. G. Mitchell & B. Salau (pp. 339–352, 14 ref.). Investigations on the use of sludge as a fertilizer in a market garden area north of Adelaide, South Australia, by M. P. C. de Vries (pp. 445–450, 10 ref.). Elimination mechanisms by soil filtration and application as a hillside seepage system in the area of a reservoir for potable water, by A. Grau (pp. 459–472). One paper is abstracted separately in FSTA and can be found in the author index under International Association on Water Pollution [Wastewater Symposium]. AL

71

Factors affecting heavy metal content of garden vegetables.

Preer, J. R.; Stephens, B. R.; Sekhon, H. S.

Abstracts of Papers, American Chemical Society 178 (1) ENVR 139 (1979) [En] [Interdisciplinary Sci. Program, Univ. of District of Columbia, Washington, DC 20001, USA]

Analyses of soil and vegetables from gardens in metropolitan Boston and Washington, DC, indicate the existence of elevated Pb and Cd content in some gardens. The analytical method involves dry ashing of dry, powdered vegetable samples, and shows both improved sensitivity over wet ashing and good agreement with certified values for Pb and Cd in NBS Standard Reference Materials. The heavy metal content of the vegetables analysed shows a strong dependence on the edible part, with garden fruits lower in heavy metals than leafy or root vegetables. Sp. differences in Pb and Cd uptake among leafy vegetables have been observed. Elevated Pb content was found in leafy vegetables grown near heavy traffic, and in leafy and root vegetables from gardens with high soil Pb content. Elevated Cd content was found in gardens with elevated soil Cd and those with low soil pH. AS

72

Performance and tissue mineral composition of ruminants fed cage layer manure in combination with monensin.

Pravee Vijchulata; Henry, P. R.; Ammerman, C. B.; Becker, H. N.; Palmer, A. Z.

Journal of Animal Science 50 (1) 48–56 (1980) [25 ref. En] [Dep. of Anim. Sci., Univ. of Florida, Gainesville, Florida 32611, USA]

24 steers, average initial wt. 256 kg, were used in a 2×3 factorial arrangement of treatments to determine the effect of monensin (22 g/t) in combination with 3 levels of cage layer manure (CLM) from poultry as a replacement for soybean meal in finishing diets. Average daily gains, feed intake and feed conversion, and ruminal propionic acid concn. were determined for 0, 12.5 and 25.0% CLM with and without monensin. Carcass evaluation showed no significant differences due to these feeding treatments in quality or yield grades, dressing %, or flavour or juiciness of broiled steaks. Addition of CLM increased Ca ($P < 0.01$) in muscle, Cu ($P < 0.01$) in liver, Mg ($P < 0.01$) and P ($P < 0.05$) in kidney, As ($P < 0.05$) in kidney and muscle, and decreased Fe ($P < 0.05$) in kidney. Levels of As, Pb, Cd and Hg did not accumulate to levels harmful to ruminants. AL

73

Effects of dried digested sludge and corn grown on soil treated with liquid digested sludge on performance, carcass quality and tissue residues in beef steers.

Bertrand, J. E.; Lutrick, M. C.; Breland, H. L.; West, R. L. *Journal of Animal Science* 50 (1) 35-40 (1980) [13 ref. En] [Agric. Res. Cent., Univ. of Florida, Jay, Florida 32565, USA]

24 steers were randomly allotted and fed 1 of 3 diets for 141 days to determine the effects of digested municipal sludges on performance, carcass quality and concn. of selected potentially toxic metals in liver, muscle and kidney tissues. The experimental diets consisted of (i) control corn diet, (ii) CDS corn diet, i.e. 500 g/head/day of dried Chicago digested sludge (CDS) incorporated into the control corn diet, and (iii) LDS corn diet, i.e. corn produced from soil treated with surface applications totalling 7.6 cm/ha of Pensacola liquid digested sludge (LDS) prior to planting. Diets (ii) and (iii) had no effect on performance and carcass quality measurements of beef steers. No significant differences in concn. of selected metals were detected in livers and kidneys of steers fed (i) and (iii). With steers fed (ii), the Cd, Cu, Fe and Pb concn. in livers were higher ($P < 0.01$ for Cd, Cu and Fe; $P < 0.05$ for Pb); metal concn. in muscles were all within accepted tolerance or guideline limits; accumulations of Cd, Fe, Hg and Pb in kidneys were higher ($P < 0.01$) than those of the other 2 diets; and higher ($P < 0.01$) Cd concn. were observed in livers and kidneys. Since Cd exposure can cause kidney damage, the Cd content of a sewage sludge could determine the amount that could be safely applied to agricultural land. AS

74

[Polarographic method for determination of lead and cadmium in meat and meat products.] [Lecture]

Shumkova, I. A.; Karpova, I. N. *Proceedings of the European Meeting of Meat Research Workers* No. 24, L6:1-L6:6 (1978) [12 ref. Ru, de, en, fr] [Vses. Nauchno-issled. Inst. Myasnoi Promyshlennosti, Moscow, USSR]

It was found that Pb and Cd could be determined simultaneously in meat and meat products by the method of Manuilova & Spektor [FSTA (1978) 10

5]557] provided ashing was carried out by the procedure of Friend et al. [*Atomic Absorption Newsletter* (1977) 16 (2) 46] modified by reduction of concn. of magnesium nitrate solution from 10 to 2.5%. Using the PPT-1 polarograph (USSR), with a sensitivity of 0.01 mg/kg, recoveries of $\geq 94\%$ Pb and 79-102% Cd, and reproducibility of 2.4-18.0% (variation coeff.) were obtained depending on concn. of Pb and Cd in samples. [See FSTA (1980) 12 8S1280.] SKK

75

The effect of cadmium contained in fertilizers on the cadmium content of vegetables.

Jaakkola, A.; Korkman, J.; Juvankoski, T.

Journal of the Scientific Agricultural Society of Finland 51 (3) 158-162 (1979) [3 ref. En, fi] [Dep. of Agric. Chem. & Physics, 01 300 Vantaa 30, Finland]

Radish, spinach and lettuce were grown in 1977 and 1978 on a soil (clayey fine sand) which had been treated in both yr at the rate of 1000 kg/ha with an NPK fertilizer containing 1.5, 30, 57 or 81 mg Cd/kg. The fertilizer was broadcast by hand and then mixed into the soil by harrowing, each plot receiving the same Cd level in each yr. After harvesting, radish tops and roots, spinach and lettuce were analysed for Cd by flameless AAS; results were compared to those obtained for rye grass. An increase in the Cd content of the fertilizer appeared, in many cases, to lead to an increase in the Cd content of the plants. However, the variation was so great as to make it impossible to decide whether the effect was real or whether the differences were accidental. Of the 4 crops, spinach appeared to take up the largest amount of Cd and rye grass the smallest amount. JA

76

Simultaneous acid extraction of six trace metals from fish tissue by hot-block digestion and determination by atomic-absorption spectrometry.

Agemian, H.; Sturtevant, D. P.; Austen, K. D. *Analyst* 105 (1247) 125-130 (1980) [7 ref. En] [Canada Cent. for Inland Waters, 867 Lakeshore Road, PO Box 5050, Burlington, Ontario, Canada L7R 4A6]

A simple and rapid digestion method is reported for the simultaneous acid extraction of Cr, Cu, Zn, Cd, Ni and Pb from high-fat fish tissue. Samples are digested with nitric and sulphuric acids at 150°C in a modified Al hot-block. The method is specially set up for fish sample sizes of up to 5 g, for low level detection of these elements. After digestion, acid extracts of the sample are analysed by direct flame AAS for Cu, Zn and Cr. The other 3 elements, Cd, Ni and Pb, are concentrated by chelation with ammonium tetramethylene dithiocarbamate followed by solvent extraction with isobutyl methyl ketone and determined by flame AAS. The ease, rapidity and safety by which samples can be processed by this method make it suitable for routine preparation of a large number of samples simultaneously. AS

77

Studies on the chemical nature of and bioavailability of As, Cd and Pb in selected marine fishery products.

Uthe, J. F.; Freeman, H. E.; Sirota, G.; Chou, C. I. *Abstracts of Papers, American Chemical Society* 178 (1) AGFD 18 (1979) [En] [Fisheries & Oceans Canada, PO Box 550, Halifax, Nova Scotia, Canada B3J 2S7]

Current food safety agencies assume that compounds of toxic elements occurring in foods are equitoxic and set tolerances based upon total levels of the toxic element. Research into the nature of naturally occurring As in flatfish has shown that the major form of As is a stable, water soluble, compound rapidly excreted by man in the urine. Little inorganic As was present in fish tissue. A study comparing the bioavailability to rats of 3 dietary forms of Cd (CdCl₂/casein; naturally occurring Cd in canned lobster digestive gland and Cd in canned kidney/liver preparation from pigs injected with low doses of CdCl₂) showed marked differences in bioavailability in spite of the diets containing equivalent amounts of protein, calories, Ca, Se and Zn. Development of analytical methodology for the determination of tetraalkyl lead compounds in fish products indicated that tetraalkyl lead compounds account for substantial percentages of the total Pb content of these products. AS

78

[Drinking water. Determination of cadmium ions.] Hungary, Magyar Szabványügyi Hivatal *Hungarian Standard MSZ 448/39-79*, 6pp. (1979) [Hu]

79

[Present knowledge of heavy metals in milk and milk products.] *Schwermetalle in Milch und Milchprodukten, gegenwärtiger Stand der Kenntnisse.* Carl, M.

Landwirtschaftliche Forschung Sonderheft 34/1, 95-102 (1978) [16 ref. De, en, fr] [Milchwirtschaftliche Untersuchungs- & Versuchsanstalt, Hirnbeinstraße 10, D-8960 Kempten, Federal Republic of Germany]

An examination of information on contamination of milk and milk products with As, Pb, Cd, Hg, Sn, Cu and Fe shows considerable variations and analytical errors. The avoidance of errors and suitable estimation methods are discussed. Milk contributes only slightly to the total dietary intake of toxic heavy metals.

Comparisons of Hg estimation by various methods showed the magnitude of systematic errors. Sources of systematic errors and their avoidance are discussed and a modification of Vondenhof & Beindorf's method [FSTA (1976) 8 10C494] is described which avoids systematic errors and allows reliable detection of contaminations. RM

80

[Pb and Cd in enamelled or ceramic household utensils.]

Beckman, I.; Movitz, J.; Nygren, M.; Slorach, S. A. *Var Föda* 31 (3) 193-197 (1979) [Sv, en] [Livsmedelslab., Statens Livsmedelsverket, S-751 26 Uppsala, Sweden]

A brief report is given of studies on extractability of Pb or Cd from 381 decorated ceramic dishes etc., and 23 enamelled items, during holding for 24 h at room temp. in contact with 4% acetic acid. Of the ceramic items, 5

(2%) yielded >0.1 mg Cd/l, 36 (11%) yielded >1 mg Pb/l and 12 (4%) yielded >0.1 mg Cd/l + >1 mg Pb/l. The highest Pb and Cd release values recorded were, resp., 77 mg/l and 7 mg/l. All 23 enamelled items released <0.1 mg Pb/l; 4 released >0.1 mg Cd/l. Implications for food contact applications of coloured ceramic or enamelled utensils are discussed. AJDW

81

[Heavy metal content (As, Pb, Cd, Hg) of vegetables which grow above ground, and fruits.] *Gehalt an Schwermetallen (Arsen, Blei, Cadmium, Quecksilber) in oberirdisch wachsenden Gemüse- und Obstarten.* Barudi, W.; Bieling, H. J.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 170 (4) 254-257 (1980) [5 ref. De, en] [Inst. für Lebensmitteltech. - Frucht- und Gemüsetech. - der Tech. Univ., Königin-Luise-Strasse 22, D-1000 Berlin 33]

157 samples of 16 types of vegetable, whose aerial tissues are consumed, and 83 samples of 6 var. of fruit were examined by AAS for As, Pb and Hg contamination. Leafy vegetables were found to be more heavily contaminated than the other vegetable types. Fruits without exception had less heavy metals than vegetables. The results obtained were compared with the guide line values of the German regulatory authority ZEBS [Zentrale Erfassungs- und Bewertungsstelle für Umweltchemikalien] and with the recommendations of WHO for weekly tolerance values for Pb, Cd and Hg. It was determined that the average weekly exposure of the population of the Federal Republic of Germany is below the max. tolerance level. AS

82

Heavy metal concentrations in the muscle tissue of 12 species of teleost from Cockburn Sound, Western Australia.

Plaskett, D.; Pötter, I. C.

Australian Journal of Marine and Freshwater Research 30 (5) 607-616 (1979) [24 ref. En] [Murdoch Univ., Murdoch, WA 6153, Australia]

The wet and dry concn. of Cd, Zn, Cu, Pb, Fe, Mn, Ni, Cr and Co were determined in filets of muscle tissue from 12 species of commercial teleost caught in Cockburn Sound: sea mullet (*Mugil cephalus*), yellow-eye mullet (*Aldrichetta forsteri*), Australian herring (*Arripis georgianus*), King George whiting (*Sillago punctata*), yellow-finned whiting (*S. schomburgkii*), cobbler (*Cnidogobius macrocephalus*), sea garfish (*Hyporhamphus melanochir*), tailor (*Pomatomus saltatrix*), rock flathead (*Platycephalus laevigatus*), small-toothed flounder (*Pseudorhombus jenynsii*), skipjack trevally (*Caranx georgianus*), and six-lined trumpeter (*Pelastes sexlineatus*). Tabulated results showed max. concn. for each metal to be well below the National Health and Medical Research Council (NHMRC) standards and the W. Australian Food and Drug Regulations values, and many times lower than in invertebrates, e.g. mussels (*Mytilus edulis*). Highest individual values (µg/g wet wt.) were: Cd 0.18, Zn 21.6, Cu 1.38, Pb 1.24, Fe 14.0, Mn 0.99, Cr 0.36, Ni 0.89, and Co 0.52. RM

83

Concentrations of arsenic, selenium and ten heavy metals in school shark, *Galeorhinus australis* (Mackay), and gummy shark, *Mustelus antarcticus* Günther, from south-eastern Australian waters. Glover, J. W.

Australian Journal of Marine and Freshwater Research 30 (4) 505-510 (1979) [13 ref. En]

The max. concn. of As, Cd, Cu, Mn, Se and Zn in the edible flesh of *G. australis* and *M. antarcticus* were found to be 30, 0.08, 0.6, 0.6, 0.8 and 4.8 µg/g wet wt. resp. The concn. of Co, Cr, Pb, Mo and Ni were below the limits of detection of the methods used (0.3, 0.5, 0.1, 0.2 and 0.2 µg/g resp.). Samples for analysis were taken from 1 male and 1 female shark of each sp. caught in 6 areas of S.E. Australian waters and wherever possible the concn. of the elements were correlated with the sp., sex and site of capture. (Samples were taken from the largest shark in each sp., sex and locality category). AS

84

[Distribution of heavy metals and its characteristics in albacore (*Thunnus alalunga*) and bonito (*Katsuwonus pelamis*).]

Honda, K.; Matsuda, M.; Tatsukawa, R.
Journal of the Agricultural Chemical Society of Japan [Nihon Nogei Kagakkai-shi] 53 (6) 177-182 (1979) [16 ref. Ja, en] [Dep. of Environment Conservation, Ehime Univ., Tarumi 3-5-7, Matsuyama 790, Japan]

The detailed distribution of heavy metals (Cu, Cd, Zn and Hg) was investigated in an albacore and a bonito, both caught off Java Island, remote from industrialized areas. Detn. for 11 organ, 18 muscle and 15 skin samples were made by AAS. In muscles, high concn. of Cu, Cd and Zn were found in dark muscle rather than in white muscle, but there were no apparent differences in Hg concn. between the 2 types. In the viscera, remarkably high concn. of Cu, Cd and Zn were found in the liver, while their concn. were low in brain and gill filaments. Hg was found to accumulate to a greater extent in muscle than in liver. It was also found that the concn. of Zn in black skin tissue was 2-4 times higher than that in white skin. Implications of the results for ecological and food hygienic analysis methods are discussed. [From En summ.] JRR

85

Cadmium, lead and zinc concentrations in soils and in food grown near a zinc and lead smelter in Zambia.

Nwankwo, J. N.; Elinder, C.-G.
Bulletin of Environmental Contamination and Toxicology 22 (4/5) 625-631 (1979) [16 ref. En] [Water Quality Lab., Water Resources Res. Unit, Nat. Council for Sci. Res., PO Box CH 158, Chelston, Lusaka, Zambia]

Concn. of Cd and Pb in 29 samples of soil and 39 food samples (maize, spinach, cabbage, rape, lettuce, kaffir corn, and rice) grown close to a Zambian Pb and Zn smelter, the Broken Hill plant in Kabwe, which had been in operation from 1906 to 1975, were investigated. Samples from Lusaka and its suburbs were used as

control material. Food samples, 19 from Kabwe region and 20 from the Lusaka region, were analysed. The food materials were oven-dried at 105°C prior to grinding in an Al cast blender, dry-ashed twice at 450°C and analysed by flame AAS. 7 maize samples grown within a 3 km radius of the smelter had Cd concn. ranging from 0.028 to 0.116 µg Cd/g dry wt. and Pb concn. ranging from 0.57 to 1.36 µg/g dry wt. Average Cd concn. was 0.064 µg/g and average Pb concn. was 0.90 µg/g dry wt. Maize samples from Lusaka had considerably lower concn. of Cd ranging from 0.002 to 0.088 µg/g than those grown near the smelter. Cd concn. in 3 samples of fresh vegetables obtained close to the west side of the plant were excessively high i.e. > 1 µg Cd/g dry wt. 2 of the food samples obtained from the Kabwe market had high Cd and Pb concn.; whereas the other 5 samples had low concn. i.e. most probably grown in areas outside Kabwe. Highest Cd concn. were generally recorded in spinach, cabbage and rape. VJG

86

Cadmium retention in rats fed either bound cadmium in scallops or cadmium sulfate.

Lagally, H. R.; Biddle, G. N.; Siewicki, T. C.
Nutrition Reports International 21 (3) 351-363 (1980) [25 ref. En] [Nat. Oceanic & Atmospheric Administration, Southeast Fisheries Cent., PO Box 12607, Charleston, S. Carolina 29412, USA]

Feeding trials were conducted to compare the effects of dietary sources of Cd and protein on excretion and retention of Cd in weanling rats. Differences were observed in the retention, but not excretion, of Cd after a 4-wk feeding period in which rats received either naturally occurring Cd in calico scallops or Cd as cadmium sulphate added to a standard casein diet; Cd retention was lower in kidneys of rats fed the scallop diet. In a 2nd experiment when equal levels were added to cooked or uncooked low-Cd bay scallop or casein based diets, Cd retention was lower among scallop fed animals. Cooking the scallop did not influence the parameters examined. As with Cd, arsenic was found to accumulate in rat tissues at a higher level when ingested as arsenic trioxide vs. naturally bound As in scallops. SP

87

Contamination of vegetables with heavy metals.

[Lecture]

Fritz, D.; Venter, F.

Acta Horticulturae No. 93, 403-412 (1979) [28 ref. En] [Dep. of Veg. Crops, Tech. Univ. of Munich, D-8050 Freising-Weihenstephan, Federal Republic of Germany]

In order to prepare baseline data for further studies, heavy metals (Zn, Cu, Pb, Ni, Cr, Cd, and in some cases Hg) were determined by AAS in samples of 10 different vegetables from 6 Bavarian areas remote from anthropogenic heavy metal contamination. Additionally, pot trials were conducted in which vegetables were grown with increasing amounts of sewage sludge compost. The investigations showed that heavy metal levels were generally highest in leaves and lowest in fruits. Independent of the vegetable group, the heavy metals were present in decreasing amounts in the

order Zn > Cu > Pb > Ni > Cr > Cd > Hg. Pot trials showed that different vegetables react differently to the presence of the sewage sludge with respect to heavy metal uptake. In most cases levels (primarily of Zn and Cu) were elevated more in leaves than in fruits and tubers. Additionally, there seems to be some evidence of plant-specific uptake of some heavy metals. [See FSTA (1980) 12 11]1566.] JRR

88

Trace metal uptake by three species of mollusks.

Greig, R. A.

Bulletin of Environmental Contamination and Toxicology 22 (4/5) 643-647 (1979) [7 ref. En] [Nat. Marine Fisheries Service, Northeast Fisheries Cent., Milford Lab., Milford, Connecticut 06460, USA]

Investigations were carried out into the uptake of Ag, Cd and Cu by (i) ocean quahogs, (ii) surf clams, and (iii) oysters when they were exposed to all the metals simultaneously. The molluscs were placed in black aquaria and flowing, sand-filtered seawater (containing 0, 10 and 20 parts/billion of each of Ag, Cd and Cu) was introduced. They were removed at intervals of 0, 15, 29 and 43 days and analysed for uptake of Ag, Cd and Cu using the procedure of Greig [*Marine Pollution Bulletin* (1975) 6, 72]. Results are tabulated. (iii) took up all metals to a greater extent than either (i) or (ii). (ii) took up nearly as much Ag as (iii), especially at the 20 parts/billion level. (ii) accumulated much less Cd and Cu than (iii). (iii) uptake of Cu was much greater than either (i) or (ii). (i) took up more Ag than it did Cd; the amount of Ag was similar to the amount of Cu accumulated by this animal. VJG

89

[Lead and cadmium contents in the meat and organs of cattle. II. Cattle from an area of lead contamination.]

Untersuchungen über den Blei- und Cadmiumgehalt in Fleisch und Organen von Schlachtrindern. II. Rinder aus einem bleischüssigen Gebiet.

Kreuzer, W.; Bunzl, K.; Kracke, W.

Fleischwirtschaft 59 (10) 1529-1542 (1979) [48 ref. De, en] [Inst. für Hygiene & Tech. der Lebensmittel Tierischen Ursprungs, Veterinärstrasse 13, 8000 Munich 22, Federal Republic of Germany]

253 Red-and-Black Pied cattle of different ages and sexes were examined for Pb and Cd contents in kidneys, liver and muscle. The animals were taken from (i) heavily Pb contaminated land, from (ii) land regularly flooded by 3 streams draining a Pb contaminated area, and from (iii) land with no obvious Pb contamination. Tabulated results showed <0.05 mg/kg Pb in muscle meat from all 3 groups as well as from a pre-alpine region, group (iv), [see ref.]. Pb contents (95% confidence limits) were in liver, 1.18-1.70 (mean 1.48) mg/kg, 0.84-1.25 (1.12), 0.23-0.34 (0.28) and 0.13-0.15 (0.14); in kidneys 2.30-3.26 (2.69), 1.59-2.10 (1.83), 0.51-0.65 (0.57), and 0.30-0.33 (0.31); kidney:liver ratio 1.8, 1.6, 2.0 and 2.2; kidney:muscle ratio > 53.8, > 36.6, > 11.4 and > 6.2; and liver:muscle ratio > 29.6, > 22.4, > 5.6 and > 2.6, for groups (i)-(iv) resp. Corresponding Cd contents were: muscle > 0.005, liver (groups (i)-(iii)) 0.10-0.16 (0.12-0.13) and (iv) 0.05-0.06 (0.05); kidneys

0.36-0.78 (0.48-0.67) and 0.20-0.26 (0.23); and kidney:liver ratio 5.6, 3.7, 4.5 and 4.6; kidney:muscle ratio > 134, > 96, > 118, > 46; and liver:muscle ratio > 24, > 26, > 26, > 10, for groups (i)-(iv) resp. On farms feeding large amounts of beets, beet tops and silage, very high Cd and sometimes also Pb contents were found in the organs of 1½ yr old animals. [Continued in following abstr.] RM

90

[Lead and cadmium contents in the meat and organs of cattle. II. Cattle from an area of lead contamination.]

Untersuchungen über den Blei- und Cadmiumgehalt in Fleisch und Organen von Schlachtrindern. II. Rinder aus einem bleischüssigen Gebiet.

Kreuzer, W.; Bunzl, K.; Kracke, W.

Fleischwirtschaft 59 (10) 1529-1542 (1979) [48 ref. De, en] [Inst. für Hygiene & Tech. der Lebensmittel Tierischen Ursprungs, Veterinärstrasse 13, 8000 Munich 22, Federal Republic of Germany]

[Continued from preceding abstr.] Results confirmed earlier findings on correlations of Pb and Cd contents of livers and kidneys, and the dependence of Cd in the organs on the age of the animals; Pb contents in the organs of older animals increased only after prolonged high intake and were more evenly distributed within the body than Cd. Great variations in contents of both metals were observed within the test groups. 'Guide value 79' for Pb in livers (0.8 mg/kg) was exceeded in nearly all livers from (i) and > 50% from (ii) animals, and even more in kidneys where 1.0 mg/kg was always exceeded. 'Guide value 79' for Cd in liver (0.5 mg/kg) was exceeded in 7.5% of cases in group (i), 1% in group (iii). Even 1.0 mg/kg as permissible max. was exceeded only in 18% of kidneys from groups (i)-(iv). Possible legal limitations on consumption of kidneys from older animals and from polluted areas are discussed (e.g. utilization in processed meats or for animal feed only). [See FSTA (1979) 11 5S868 for part I.] RM

91

[Volatile solvents and pesticide residues in flavourings.]

[Review]

Peyron, L.

Rivista Italiana Essenze, Profumi, Piante Officinali, Aromi, Saponi, Cosmetici, Aerosol 61 (2) 46-52 (1979) [70 ref. Fr]

[Lantier Aromatiques, Grasse, France] This review discusses problems of solvent, pesticide and heavy metal traces in food flavourings in relation to intake, methods of detn. and health hazards. RM

92

Analysis of foods for lead, cadmium, copper, zinc, arsenic, and selenium, using closed system sample digestion: collaborative study.

Holak, W.

Journal of the Association of Official Analytical Chemists 63 (3) 485-495 (1980) [14 ref. En] [FDA, 850 Third Avenue, Brooklyn, New York 11232, USA]

A method for detn. of Cd, Pb, Cu, As, Se and Zn is presented. The method involves digesting a food sample with nitric acid under pressure and using

aliquots of the solution for analysis by suitable techniques. Cd, Pb, and Cu are determined by anodic stripping voltammetry (ASV) after heating with equimolar sodium nitrate/potassium nitrate; As and Se are determined by AAS after generation of their respective hydrides; Zn is determined by conventional AAS. The combined recoveries and reproducibilities (CV_R) of the collaborative study on this multielement analysis are: Cd, 89.14 (17.65) at 0.10–1.0 $\mu\text{g/g}$; Zn, 96.53 (5.59) at 16.7 and 66.7 $\mu\text{g/g}$; As, 99.50 (17.02) at 0.5 and 2.0 $\mu\text{g/g}$; Se, 95.17 (16.52) at 0.5 and 2.0 $\mu\text{g/g}$; Pb, 92.57 (15.22) at 0.3–3.0 $\mu\text{g/g}$; and Cu, 108.39 (18.30) at 1.0–10.0 $\mu\text{g/g}$. The method has been adopted as official first action for Cd, Pb, As, Se, and Zn. AS

93

Studies on the presence and determination of cadmium in foods by atomic absorption spectrophotometry.

Protima Sengupta

Journal of the Institution of Chemists (India) 52 (1) 15–17 (1980) [4 ref. En] [Cent. Food Lab. Calcutta, West Bengal, India]

Several food products were collected from the Calcutta market and analysed for the presence of Cd. Cd was present at the following levels (p.p.m.): ripe papaya, 0–0.12; carrots 0.1–0.3; wheat, 0.1–0.15; and rice, 0.08–0.2. No Cd was found in fish (pomfret and sardines), canned fish, canned papaya or bajra. CFTRI

94

[Contamination of foods with heavy metals.]

[Review]

Nabrzyski, M.

Bromatologia i Chemia Toksykologiczna 12 (4) 411–419 (1979) [52 ref. Pl] [Zaklad Bromatologii Inst. Chem. i Anal. Akad. Med., Gdansk, Poland]

This review includes tabulated data on daily intakes of Cd and Pb in different countries; contents (ranges and means) of Hg, Cd and Pb in 29 different foods; permitted levels of Hg, Cd and Pb in various foods in different countries; and foods (15) in which high levels of Hg, Cd and Pb may be expected. HBR

95

Analysis of wines for metals using atomic-absorption spectrophotometry.

Harju, K.; Ronkainen, P.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 170 (6) 445–448 (1980) [3 ref. En, de] [Res. Lab. of the State Alcohol Monopoly (Alko), Box 350, SF-00101 Helsinki, Finland]

Ca, Cd, Cr, Cu, Fe, K, Li, Mg, Mn, Na, Pb and Zn were determined using AAS in 59 Finnish ($n = 10$) and foreign ($n = 49$) wines sold in Finland. Cd and Pb were determined in a graphite furnace and the other metals with an air-acetylene flame. All wines contained only low levels of heavy metals; in all cases the concn. of Pb was $< 0.3 \text{ mg/l}$, that of Cu was $< 1.0 \text{ mg/l}$, that of Zn was $< 5.0 \text{ mg/l}$ and that of Cd was $< 0.1 \text{ mg/l}$, which are the max. levels permitted in some countries. Finnish wines contained less Pb and Mg and more Cr and Na than the foreign wines analysed. AS

96

[Heavy metal contents of canned tomato concentrates.]

Koncz, I.; Kovaczne Molnar, K.

Elelmezési Ipar 33 (7) 261–264 (1979) [Hu, en, de, ru] [Konzerv-es Paprikaipari Kutató Intézet, 1097 Budapest, Földvár ut 4, Hungary]

The following problems were investigated in laboratory experiments: what is the relationship between the heavy metal contents of canned tomato concentrates and the type of varnish applied to the inside of the can; are the soldering particles able to dissolve in the tomato concentrate and is this dependent on the quality of the varnish; and what is the period of time after which the heavy metal contents reach the limits of permitted values. Results showed that type of varnish did not affect the amount of dissolved metals in the concentrates; it was dependent entirely on faulty or damaged varnishing. However, the appearance of the inside surface of the can was much better when pigmented (double layer) varnish was used instead of transparent golden one. The soldering particles did not show any loss of wt. for any of the varnish types. The Sn content of the concentrates reached or surpassed the permitted values (250 mg/kg) on the 360th day of storage at 20°C. and on the 225th day at 37°C. During storage, the Pb content did not reach the limit of permitted values (3 mg/kg) in any of the samples. The Fe content did not surpass the original values of 30–50 mg/kg, even when iron oxide pigmented varnish was used, except in the case of TiO_2 pigmented varnish, where the Fe content increased to 250–350 mg/kg after 360 days of storage at 20°C (at 37°C the cans were also blown by H_2). ESK

97

[Heavy metal contents in homogenized fruit products for infants.]

Spadoni, S.; Massi, C.; Micozzi, F.; Ruggeri, P.

Rivista della Società Italiana di Scienza dell'Alimentazione 9 (2) 123–126 (1980) [18 ref. It] [Lab. di Chim., Ufficio d'Igiene & Sanità, Rome, Italy]

Concn. of Pb, Cu, Zn and Cd were determined by AAS in samples of homogenized (i) pears, (ii) apples and (iii) mixed fruit, products of 4 manufacturers. Tables of results are given. Mean values and ranges were (p.p.m.): Pb, (i) 0.138 and 0.065–0.250, (ii) 0.124 and 0.078–0.220, and (iii) 0.110 and 0.060–0.230; Cu, (i) 0.80 and 0.42–1.00; (ii) 0.46 and 0.35–0.63; and (iii) 0.70 and 0.42–1.10; Zn, (i) 1.7 and 1.1–2.9, (ii) 1.2 and 0.45–2.7, and (iii) 1.5 and 0.70–2.3; Cd, (i) 0.0044 and 0.002–0.006, (ii) 0.0037 and 0.002–0.006, and (iii) 0.0070 and 0.003–0.013. The toxicological significance of these heavy metal concn. in foods for infants is discussed. AJDW

98

[Pesticides, metal residues, antibiotics.] [Review]

Luquet, F. M.; Mahieu, H.; Mouillet, L.; Boudier, J. F. *Alimentation et la Vie* 67 (2) 73–90 (1979) [30 ref. Fr] [ISHA, BP 138, Champlan, 91160 Longjumeau, France]

This review considers organochlorine pesticides, polychlorinated biphenyls, metals (Cu, Fe, Mn, As, Cd, Hg and Pb) and antibiotics residues in milk in France. Regional and seasonal variations are discussed.

Mention is also made of the high contamination of human milk with organochlorine pesticide residues. MEG

99

Accumulation of iron, manganese, zinc and cadmium by the Australian freshwater mussel *Velesunio ambiguus* (Phillipi) and its potential as a biological monitor.

Jones, W. G.; Walker, K. F.

Australian Journal of Marine and Freshwater Research 30 (6) 741-751 (1979) [35 ref. En] [Univ. of Adelaide, Adelaide, S. Australia 5000, Australia]

The accumulation of Fe, Mn, Zn, and Cd by freshwater mussels and their response to changes in environmental Fe concn. are considered. Tabulated results show that metal loads varied markedly between individuals from the same population, e.g. mean, s.d. and coeff. of variation from 1 sampling date (23 mussels) were ($\mu\text{g/g DM}$, and %): Fe 6764, 2782, and 41%; Mn 4796, 2580 and 53%; Zn 340.3, 126.7, and 37%; and Cd 0.689, 0.631 and 92%. The variability was partly accounted for by systematic relationships between metal loads and body wt. and age, but not sex. The distribution of metals between the major organs is shown in a table and discussed. No clear relation was found between the Fe concn. in river water and in mussels. RM

100

[Cadmium in the fish-pond ecosystem.]

Bican, J.; Drbal, K.

Zivocisna Vyroba 24 (11) 839-845 (1979) [14 ref. Cs, ru, en, de] [Ekonomická Fak., Vysoká Škola Zemedelská, 370 01 Ceske Budejovice, Czechoslovakia]

Mean values with ranges for Cd contents of flesh, roes and organs (liver, gills, spleen, kidney, gonads, scales) of unstated numbers of freshwater fish include the following for flesh, and roes when given ($\mu\text{g/g DM}$): carp (*Cyprinus carpio*), 0.28 (0.18-0.49); tench (*Tinca tinca*), 0.33 (0.27-0.55); maraena (*Coregonus lavaretus maraena*), 0.31 (0.18-0.43); pike (*Esox lucius*), 0.33 (0.28-0.39) and 0.19 (0.11-0.27); pike-perch (*Stizostedion lucioperca*), 0.34 (0.32-0.36) and 0.24 (range not stated); and perch (*Perca fluviatilis*), 0.63 (0.44-0.75) and 0.22 (0.13-0.40). Waters of 2 South Bohemian ponds contained on average 1.8 $\mu\text{g Cd/l}$ during the yr; their sources ranged from 0.6 to 5.4 $\mu\text{g/l}$. SKK

101

Determination of lead and cadmium in fish and clam tissue by atomic absorption spectrometry with a molybdenum and lanthanum treated pyrolytic graphite atomizer.

Poldoski, J. E.

Analytical Chemistry 52 (7) 1147-1151 (1980) [21 ref. En] [US Environmental Protection Agency, 6201 Congdon Boulevard, Duluth, Minnesota 55804, USA]

A Mo- and La-treated pyrolytically coated graphite tube was employed for furnace AAS of Pb and Cd directly in nitric-perchloric acid tissue digests. La tended to promote the formation of a smooth Pb atomization peak for aid in peak quantitation. Both Mo

and La helped reduce chemical interference and interference from uncompensated background signals during analyte atomization. Under typical conditions, average analytical recoveries were 90-110% for both Pb and Cd, and peak height reproducibility was about 2-3% when working sufficiently above detection limits. Accuracy of the method was assessed by analysing NBS SRM (standard reference material) 1577 bovine liver and performing alternate determinations by anodic stripping voltammetry. AS

102

[Cadmium contents in kidneys, livers, muscles and feed of pigs from various feed systems.] Cadmium-Gehalte in Nieren, Lebern, Muskulatur und Futtermitteln von Schlachtschweinen verschiedener Fütterungsregime.

Ostertag, J.; Kreuzer, W.

Archiv für Lebensmittelhygiene 31 (2) 57-64 (1980) [34 ref. De, en] [Inst. für Hygiene & Tech. der Lebensmittel Tierischen Ursprungs, Schellingstrasse 10, 8000 Munich 40, Federal Republic of Germany]

334 kidney, 322 liver and 211 muscle meat samples from 10 pig fattening stations and corresponding feeds were analysed for Cd content by wet ashing and AAS. Results, shown graphically and in tables, revealed Cd contents of 23-1000 $\mu\text{g/kg wet wt.}$ in kidneys, 10-656 in livers and 0-82 in muscle, with median values 271 (95% confidence range 260-287), 74 (64-85) and 6 (5-7) $\mu\text{g/kg}$ resp. Highest Cd contents were nearly always found in the kidneys, (i.e. 2-9 times higher than liver and 15-40 times higher than muscle). Positive correlations at 99.9% were found between Cd contents of kidney with liver, liver with muscle and kidney with muscle. The Cd contents of the feed ranged from 30 to 260 $\mu\text{g/kg DM}$. The ratio Cd content in kidney:Cd in feed showed much higher Cd residues in kidneys of animals fed on kitchen waste or on root crops than in those fed cereals or whey; this difference was not observed in livers or muscle. Possible reasons for the differences observed are discussed. [From En summ.] RM

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H. BROOKES

EDITOR

1

[Symposium 1978. Current state and achievements of chemical and biological agricultural research.] Kongressband 1978. Stand und Leistung agrikulturchemischer und agrikulturbioologischer Forschung. [Conference proceedings] Germany, Federal Republic of, Verband Deutscher Landwirtschaftlicher Untersuchungs- & Forschungsanstalten (VDLUFA) *Landwirtschaftliche Forschung* Sonderheft 35, 724pp. (1979) [De, en, fr]

The 90th VDLUFA meeting, held in Augsburg on Sept. 18-22, 1978 included the following lectures: Demands of nutrition medicine on the quality of plant foods, by G. Wolfram (pp. 32-42, De, en, fr, 12 ref.). Fertilization and food quality of different cropping systems, by A. Finck (pp. 122-132, De, en, 18 ref.). Uptake of heavy metals by various cultivated plants in a pot trial with a soil of high Cu content, by A. Wünsch, A. Amberger and R. Gutser (pp. 326-334, De, en, fr, 14 ref.). Uptake of heavy metals by various plants in a pot trial from soils with long-term or single application of sewage sludge, by R. Gutser, A. Amberger and A. Wünsch (pp. 335-349, De, en, fr, 32 ref.). Another 19 papers are abstracted individually in FSTA, and are listed in the author index under Germany, Federal Republic of, Verband Deutscher Landwirtschaftlicher Untersuchungs- & Forschungsanstalten (VDLUFA) [90th Symposium]. AJDW

2

[Brief report on field experiments with town waste compost and sewage sludge. Heavy metals in crops.] Ein Kurzbericht über langjährige Feldversuche mit Müllkomposten und Klärschlämmen. Schwermetallgehalte in der Erntemasse. [Lecture] Kick, H.; Poletschny, H.

Landwirtschaftliche Forschung Sonderheft 35, 412-418 (1979) [5 ref. De, en, fr] [Agrikulturchemisches Inst. der Univ. Bonn, Meckenheimer Allee 176, D-5300 Bonn 1, Federal Republic of Germany]

Effects of urban waste application on heavy metals in soil and crops were studied. Tabulated data showed that the metal contents in fodder beets, sugar beets, potatoes and grain maize were not increased in field experiments on 3 different soils for periods of 20, 9 and 6 yr after application of 98 t/ha over 20 yr, 1800 t/ha in a single application, or up to 250 m³ liquid sewage sludge/ha. [See FSTA (1981) 13 1A3.] RM

3

[Release of Pb and Cd from ceramic and enamelled household utensils.]

Beckman, I.; Movitz, J.; Nygren, M.; Slorach, S. *Var Föda* 31 (suppl. 1) 80pp. (1979) [20 ref. Sv, en] [Livsmedelslab., Statens Livsmedelsverk, S-751 26 Uppsala, Sweden]

Studies were conducted on release of Cd and Pb from 381 glazed ceramic dishes etc. and 23 enamelled items. Most samples were tested by a technique involving extraction with 4% acetic acid for 24 h at room temp.; modified extraction methods were also evaluated. Pb and Cd were determined in the extracts by AAS. Tables of results are given. Of the glazed ceramic items, 5 released > 0.1 mg Cd/l but < 1 mg Pb/l. 3b released

> 1 mg Pb/l but < 0.1 mg Cd/l, and 12 released both > 1 mg Pb/l and > 0.1 mg Cd/l. Of the enamelled items, 4 released > 0.1 mg Cd/l; none released more than 1 mg Pb/l. The toxicological significance of these results is discussed and recommendations to consumers are given. AJDW

4

[Use of composted urban wastes in viticulture. Partial results from 3 year trials.] Einsatz von kompostierten Siedlungsabfällen im Weinbau. Teilergebnisse nach 3 Versuchsjahren. [Lecture] Pfulb, K.; Völkel, R.; Enkelmann, R.; Scholl, W.; Wiechens, E.

Landwirtschaftliche Forschung Sonderheft 35, 377-393 (1979) [8 ref. De, en, fr] [Staatliche Landwirtschaftliche Untersuchungs- & Forschungsanstalt, Augustenberg, Postfach 41 09 43, D-7500 Karlsruhe 41, Federal Republic of Germany]

Effects of 3 yr application of a total of 150, 300 and 600 t composted urban wastes/ha to acid and alkaline vineyard soils were investigated. Tabulated results showed no significant increases in heavy metal concn. (Mn, Zn, Cu, Pb, Cd, Hg) in musts and wines at any level of application and on any soil. In all cases the levels of heavy metals in wine were far below legal tolerance levels; concn. in musts were: Cu, 0.2-0.4 p.p.m.; Zn, 0.4-1.2 p.p.m.; Pb, 0.03-0.10 p.p.m.; Cd, 0.8-1.3 parts/billion; Hg, 0.04-0.16 parts/billion; and Mn, 1.6-2.3 p.p.m. Levels in wines were generally lower. [See FSTA (1981) 13 1A3.] RM

5

[High levels of Cd in Swedish wild mushrooms.] Movitz, J.

Var Föda 32 (5) 270-278 (1980) [9 ref. Sv, en] [Livsmedelslab., Statens Livsmedelsverk, S-751 26 Uppsala, Sweden]

Cd concn. were determined by AAS in 88 samples of wild mushrooms collected in Sweden. Cd levels were low in all samples of *Agaricus bisporus* and *A. campestris*. All samples of *A. macrosporus* and *A. augustus* had fairly high Cd levels (average 6.0 and 3.9 mg/kg fresh wt. basis, resp.). The Cd concn. in *A. arvensis*, *A. abruptibulbus* and *A. silvicola* were variable, some samples having low and some very high (≤ 23.4 mg/kg) Cd levels. The geographical distribution of high-Cd mushrooms within Sweden suggests that the high Cd levels are not due to industrial pollution. Herbarium specimens (55-90 yr old) had Hg levels similar to those recorded for the fresh material studied. The possibility that Cd-accumulation is a genetically-mediated characteristic of fungi is briefly considered. It is recommended that the species with high Cd contents should be consumed only a few times/yr. AJDW

6

[Pb and Cd in sugar.] Blei- und Cadmiumgehalt in dem 'Grundnahrungsmittel: Zucker'.

Matter, L.

Lebensmittelchemie und Gerichtliche Chemie 34 (3) 79 (1980) [1 ref. De] [Chem. & Lebensmitteluntersuchungsamt der Stadt Duisburg, Pulverweg 39, 4100 Duisburg, Federal Republic of Germany]

Pb and Cd were determined by flameless AAS in 15 samples of sugar of various types, including sugar

cubes, brown candy sugar, coarsely-granular sugar, granulated sugar refined white sugar (from France, Belgium and the Netherlands) and Irish coffee sugar. Mean Pb concn. was 0.103 p.p.m.; Pb concn. ranged from 0.055 p.p.m. for Belgian refined sugar to 1.60 p.p.m. for brown candy sugar. Mean Cd concn. was 0.016 p.p.m.; Cd concn. ranged from 0.008 p.p.m. for Netherlands refined sugar to 0.027 p.p.m. for French refined sugar and Irish coffee crystals. AJDW

7

Heavy metal concentrations in major fractions of corn kernels.

Hinesly, T. D.; Sudarski-Pack, V.; Ziegler, E. L.; Kinder, D. H.

Prehrambeno Tehnoloska Revija 16 (1) 2-5 (1978) [4 ref. En, sh] [Dep. of Agronomy, Univ. of Illinois, Urbana, Illinois, USA]

3 single-cross maize cv. known to produce grain with resp. low, intermediate and high concn. of Cd when grown on soils enriched with sludge-borne Cd were grown in a field reclaimed from strip-mined spoil and fertilized with anaerobically digested sewage sludge during 5 yr. Samples of grain were collected from 9 separate 3-m lengths of row for each single cross. Mean values with s.e. are tabulated for Cd, Zn, Cu, Ni, Mn, Cr, Fe and Pb contents determined by flame AAS and Hg determined by cold vapour AAS in whole kernels, endosperm and remainder of kernel, defatted germ, and oil of the 3 cv.; and, for comparison, for a commercial maize germ flour. Mean contents of Cd in whole grain DM were, resp., 0.30, 0.65 and 0.93 mg/kg. Contents of Zn, Pb and Cr were also markedly higher than in grain produced in normal environments: they were resp., Zn 47.1, 41.2 and 27.3 mg/kg, Pb 1.76, 2.12 and 1.41 mg/kg, and Cr 0.52, 0.80 and 0.64 mg/kg. Of the fractions, germ showed highest accumulations of heavy metals. SKK

8

[Heavy metal content of hen eggs.] Zum Schwermetallgehalt von Hühnereiern.

Weigert, P.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 171 (1) 18-19 (1980) [9 ref. De, en] [Vet.-Untersuchungsstelle der Bundeswehr VI, Schleissheimer Strasse 416, D-8000 München 45, Federal Republic of Germany]

Heavy metal contents of hen egg yolk, white and shell (75 eggs) were determined, after freeze-drying of samples followed by wet digestion, by AAS. Moisture contents of egg white and yolk were 88% and 49%, resp. Mean contents and s.d. (in parenthesis) in yolks and whites, resp. were (p.p.m. dry wt.) Pb 0.067 (0.088), 0.085 (0.088); Cd 0.028 (0.049), 0.023 (0.023); Hg 0.006 (0.004), 0.005 (0.002); As 0.348 (0.316), 0.209 (0.180); Se 0.567 (0.544), 0.376 (0.388). No correlations were found between individual metals or between egg components. Systematic monitoring of contents of As, Se and Cd in eggs is recommended. DIH

Determination of heavy metals in sea water and marine organisms by flameless atomic absorption spectrophotometry. XII. A method for the determination of 'total cadmium' in natural water samples - limits of mere extraction methods.

Sperling, K.-R.

Zeitschrift für Analytische Chemie 301 (4) 294-299 (1980) [27 ref. En, de] [Biol. Anstalt Helgoland, Wüstland 2, D-2000 Hamburg 55, Federal Republic of Germany]

A new micro method is described for the detn. of 'total Cd' in natural waters. Samples are dried, the residue is digested with a mixture of H_2SO_4 and HNO_3 , diluted subsamples are neutralized with $NaHCO_3$ buffer and extracted by ammonium pyrrolidone dithiocarbamate in carbon tetrachloride. The reproducibility is in the range of 7% at concn. of $0.066 \mu g Cd/l$, detection limit is $< 0.002 \mu g/l$ and can be lowered further. The typical blank of $0.022 \mu g Cd/l$ is rather high in view of the sensitivity of the method, but is very constant (mean variation from the mean $0.0022 \mu g/l$). [See FSTA (1980) 12 7A483 for part XI.] [From En summ.] RM

10

[Cadmium in environmental and biological materials. Problems of analysis.]

Sacchini, A.

Rassegna Chimica 32 (1) 23-39 (1980) [82 ref. It, en] [Istituto di Merceologia, Univ. di Perugia, Perugia, Italy]

Research on Cd concn. and methods of Cd detn. in environmental and biological samples (including food) during 1969-1979 is reviewed with the aid of tabulated data. Methods discussed include AAS (flame and flameless), electrochemical methods (polarography, inverse voltammetry), neutron activation analysis, fluorescence and spectroscopic methods. RM

11

Absorption of radiocadmium and radioselenium by rats fed intrinsically and extrinsically labelled lettuce leaves.

Welch, R. M.; House, W. A.

Nutrition Reports International 21 (1) 135-145 (1980) [29 ref. En] [US Plant, Soil & Nutr. Lab., USDA, Ithaca, New York 14853, USA]

The bioavailability of varying levels of ^{109}Cd when in combination with ^{75}Se , in lettuce leaves (either intrinsically or extrinsically radio actively labelled leaves) were assessed in feeding trials of various combinations of high or low Cd and Se meals to Zn depleted rats. Results, tabulated, show that ^{109}Cd absorption increased with ^{75}Se level in the meal, particularly in rats fed intrinsically labelled lettuce leaves. ^{75}Se absorption decreased with increased levels of either Se or Cd in the meal. The biological $\frac{1}{2}$ life of ^{109}Cd was larger in rats fed high-Cd meals. The biological $\frac{1}{2}$ life of ^{75}Se was longer in rats fed intrinsically than extrinsical labelled lettuce leaves. SP

[Cd contents of foods and human organs in a large town.] Der Cadmiumgehalt in Lebensmitteln und Organen des Menschen am Beispiel einer Grossstadt.

Raffke, W.; Cumbrowski, J.; Jacobi, J.

Nahrung 24 (8) 797-802 (1980) [5 ref. De, en, ru]

[Bezirkshygiene-Inst., Berlin]

Cd was determined by AAS in a wide range of samples of food (including meat, poultry, offal, fish, eggs, milk, dairy products, fruit, vegetables, bakery products, prepared meals and sauces) from shops and a factory canteen. Tables of results are given. The highest recorded Cd concn. was 0.42 mg/kg in 1 beef sample; most samples had much lower Cd concn. Calculated weekly per capita intakes of Cd from the foods studied were well below FAO/WHO max. tolerance. Data are also given for Cd concn. in tissues of inhabitants of a large town in the German Democratic Republic.

AJDW

[Square-wave polarographic determination of copper, lead, cadmium, zinc and tin in food.]

Bestimmung von Kupfer, Blei, Cadmium, Zink und Zinn in Lebensmitteln mittels Square-wave-Polarographie. Borus-Böszörmenyi, N.

Nahrung 24 (3) 295-302 (1980) [5 ref. De, en, ru] [Cent. Authority for Food Control & Testing, Min. for Agric. & Food, Budapest, Hungary]

Studies on detn. of Cu, Pb, Cd and Zn in foods by square-wave polarography are described. No interference between these metals was observed in simultaneous analyses. Co and Mn do not interfere with Zn detn.; Ni interferes only at concn. higher than those likely to occur in foods. Average recovery is 96.7% for Zn, 100.2% for Cd. Comparative studies on detn. of Cu and Pb in tomato puree by this method and by the Hungarian standard photometric procedures showed close agreement. It is concluded that square-wave polarography is a rapid, accurate and sensitive technique for detn. of heavy metals in foods. IN

[Contents of mercury, cadmium, lead, zinc and copper in delivery milk in Lublin province and in dried milk.]

Bulinski, R.; Kot, A.; Kotulas, K.; Michniewski, J.; Szydłowska, E.

Roczniki Instytutu Przemysłu Mleczarskiego 20 (3) 71-77 (1978, publ. 1979) [28 ref. Pl, ru, en] Zakład Bromatologii Akad. Med., Lublin, Poland]

10 samples each of bulk milk obtained during Jan.-June 1976 from 10 milk collection points in Lublin province (Poland) and 10 each 1-kg dried milk samples from 10 dried milk factories throughout Poland obtained during 1976 were analysed for some heavy metals. Mean values with ranges are tabulated for individual collecting points or factories. Overall means and ranges for bulk milk and dried milk were resp. Hg 0.81 (0.31-1.34) and 8.06 (1.64-21.5) µg/kg, Cd 2.9 (1-8.1) and 21.4 (11-30.8) µg/kg, Pb 13.4 (7.1-19.1) and 64.3 (28.4-189.2) µg/kg, Zn 4.43 (3.61-5.38) and 25.43 (22.51-28.45) mg/kg and Cu 0.211 (0.19-0.23) and 2.82 (1.88-3.46) mg/kg. SKK

[Lead, cadmium, arsenic and zinc contents in fish from uncontaminated and contaminated inland waters.] Blei, Cadmium-, Arsen- und Zinkgehalte von Fischen aus unbelasteten und belasteten Binnengewässern.

Holm, J.

Fleischwirtschaft 60 (5) 1076-1083 (1980) [9 ref. De, en] [Staatl. Veterinäruntersuchungsamt Braunschweig, Dresdenstrasse 6, D-3300 Braunschweig, Federal Republic of Germany]

Within the framework of a plan for water management, and with reference to a fish re-stocking programme, the metal contents in the muscles and livers of fish from unpolluted and polluted still waters, and from unpolluted, polluted and heavily polluted running waters were determined by wet digestion and AAS. Tabulated results showed much greater metal accumulation in livers than in muscles: in perch and roach, Pb contents of liver were 3-11 ×, and Cd contents 90-600 × as high as in muscle. Metal contents in fish tended to rise with water pollution levels but differed with species. Max. contamination was found in perch, with 0.08 and 0.9 mg Pb/kg in muscle and liver resp., and 0.1 and 62 mg Cd/kg; moderate levels were found in roach, chub and tench with 0.03 and 0.12-0.26 mg Pb/kg, 0.05 and 1.0-7.8 mg Cd/kg in muscle and liver resp. Silver bream and pike came within the lowest range, with 0.01-0.03 and 0.04-0.15 mg Pb/kg, 0.007-0.02 and 0.3-1.5 mg Cd/mg, resp. A clear gradation with the distance from the immission source was also observed with the contamination levels in perch and roach at a distance of 30 km dropping to 1/10 that at 12-15 km, and to 1/100 at a distance of 70 km. The 0.5 mg Pb/kg tolerance level was exceeded only in the muscle of fish caught in 2 places from polluted and heavily polluted water, but Cd contents were above the 0.05 mg/kg tolerance level in 90% of fish muscle from heavily polluted and 29-39% from polluted water. As, Zn and Cu levels are also shown in tables but are not included in discussion of the results. RM

[Cd contamination in the food chain: water-plankton-fish in the Baltic.] Zu Fragen der Cadmiumkontamination in der Nahrungskette: Wasser-Plankton-Fisch in der Ostsee.

Manthey, J.; Baugmann, L.; Berge, H.

Wissenschaftliche Zeitschrift der Universität Rostock 27 (6) 629-632 (1978) [6 ref. De, en, fr, ru] [Bezirks-Hygiene-Inst., Stephanstrasse 18, 25 Rostock, German Democratic Republic]

Cd, Pb and Hg levels monitored in Baltic waters, plankton and fish were used to calculate accumulation factors related to the concn. in the water. Mean values found in cod, flounder and herring, resp., i.e. 3.6, 3.7 and 18.1 µg/kg Cd, 38.9, 69.9 and 60.3 µg/kg Pb, 49.4, 82.3 and 80.8 µg/kg Hg are discussed in relation to age, fishing grounds and feeding type. RM

[Simultaneous determination of Cu, Fe, Mn, Zn, Pb and Cd in plant tissues by differential pulse polarography.] Die gleichzeitige Bestimmung von Cu, Fe, Mn, Zn, Pb and Cd in Pflanzengewebe mittels Differential-Puls-Polarographie.

Wisser, K.; Wöhrle, G.

Mikrochimica Acta 1 (1/2) 129-138 (1980) [3 ref. De, en] [Inst. für Lebensmittelchemie der Univ., Kaiser-Strasse 12, D-7500 Karlsruhe, Federal Republic of Germany]

The detn. of Cu, Pb, Cd, Zn, Fe and Mn ions in plant material by differential pulse polarography in a single operation is described. Cu, Pb, Cd and Zn can be determined after incineration and dissolution in tartaric acid; Cd, Zn and Fe after addition of NH_3 , Mn after further addition of KCN. Sample size required is 0.2-0.5 g, limit of detection is about 1 $\mu\text{g/g}$. The method is especially suitable for serial analyses. [From En summ.] RM

18

Cadmium as a food contaminant. [Review]

Spickett, J. T.

Proceedings of the Nutrition Society of Australia 4, 87-94 (1979) [32 ref. En] [Dep. of Community Health Sci., W. Australian Inst. of Tech., Hayman Road, Bentley, W. Australia 6102, Australia]

This review article discusses the sources of Cd contamination of food and toxicological aspects of Cd contamination. Cd contents of a variety of food groups, including cereals and grains, meat and fish, shellfish, oils and fats, fruits, vegetables and dairy products, obtained in Western Australia are compared with values reported from other countries. In general, animal products and cereals contain more Cd (0.02-0.07 $\mu\text{g/g}$) than other foods; milk and dairy products in Western Australia contained 0.002 $\mu\text{g Cd/g}$. MEG

19

[Determination of Pb, Cd, Cu and Zn in ground water and tap water by anodic stripping voltammetry.]

Inversvoltammetrische Bestimmungen von Blei, Cadmium, Kupfer und Zink in Grundwasser und Leitungswasser.

Frimmel, F. H.; Immerz, A.

Zeitschrift für Analytische Chemie 302 (5) 364-369 (1980) [11 ref. De, en] [Tech. Univ. Marchioninstrasse 17, D-8000 München 70, Federal Republic of Germany]

Heavy metals in ground water and tap water can be determined by differential pulse anodic stripping voltammetry (DPASV), as shown by the quality of analytical results and by comparison with AAS. Concn. of 0.1 $\mu\text{g/l}$ were detectable. The results were affected by sampling method (ground water) or by the residence time in domestic pipes: up to $10\times$ the concn. was reached in stagnant as in freely running water. Water temp. was a useful aid for evaluation. [From En summ.] RM

[Analysis of water samples for heavy metals by means of automated atomic absorption spectrometry.] Untersuchung von Gewässerproben auf Schwermetalle mit der automatisierten Atomabsorption.

Kempf, T.; Sonneborn, M.

Bundesgesundheitsblatt 23 (1/2) 4-6 (1980) [4 ref. De, en] [Inst. für Wasser-, Boden- & Lufthygiene des Bundesgesundheitsamtes, Corrensplatz 1, 1000 Berlin 33]

Under German-Netherlands cooperation arrangements, work has been performed on the analysis of traces of heavy metals such as Pb, Cd, Cr, Fe, Cu and Zn some of which are toxic, in water. AAS is seen as a selective and sensitive method, since it permits a large degree of automation, and enables processing of a sufficiently large number of samples in the time available. Aspects of proportional sampling from flowing waters, and the preparation of samples, are discussed. Average values of trace elements measured in the lower Rhine are recorded. AS

21

[Pb and Cd contents of sour cherries, in relation to industrial processing after mechanical harvest.] Blei- und Cadmiumgehalte von Sauerkirschen im Hinblick auf die industrielle Weiterverarbeitung nach maschineller Ernte.

König, R.; Beckmann, G.; Lauterbach, K.

Nahrung 24 (7) 673-675 (1980) [14 ref. De] [Bezirks-Hygieneinspektion & Bezirks-Hygiene-Inst., Erfurt, German Democratic Republic]

Mechanized harvest of cherries may result in considerable losses of juice during transport; when such fruit is to be used for juice production, it is desirable to omit fruit washing before further processing. This might, however, lead to excessive carry-over of Pb or Cd from the fruit surface into the finished product. Investigations were therefore conducted on Pb and Cd concn. in washed and unwashed cherries. Mean values (with ranges in parentheses) were, for unwashed and washed cherries resp. ($\mu\text{g/kg}$ fresh wt.): Pb 41.9 (24.6-62.4) and 28.2 (14.9-51.9); and Cd 6.1 (1.3-13.9) and 3.2 (1.0-8.9). It is concluded that Cd and Pb concn. in the unwashed fruit presented no significant health hazard. IN

22

[Cadmium and copper excretion after an agaricus mushroom meal.] Cadmium- und Kupferausscheidung nach Aufnahme von Champignon-Mahlzeiten.

Schellmann, B.; Hilz, M.-J.; Opitz, O.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 171 (3) 189-192 (1980) [17 ref. De, en] [Inst. für Rechtsmed. der Univ. Erlangen-Nürnberg, D-8520 Erlangen, Federal Republic of Germany]

Excretion of Cd and Cu after meals containing chiefly wild mushrooms was studied using human volunteers. Mushrooms used (e.g. *Psalliota abruptipola*, *P. campestris*, *P. arvensis*, *Agaricus giganticus*) contained the following mean contents and ranges of Cd and Cu ($\mu\text{g/g}$ fresh wt.): in stalk + cap Cd 1.54, 0.07-3.31; Cu 3.85, 2.03-6.82; in gills Cd 3.84, 3.75-4.08; Cu 6.63, 5.47-7.87. Results showed that mushroom pieces were excreted relatively unchanged, and that Cu and Cd were largely not absorbed. DIH

[Lead, cadmium and arsenic contents in organ samples of sheep from an arid zone, e.g. Algeria.] Blei-, Cadmium- und Arsengehalte in Organproben von Schafen aus einer ariden Klimazone am Beispiel Algerien.

Holm, J.; Elsarnagawy, D.

Fleischwirtschaft 60 (7) 1387-1388 (1980) [7 ref. De, en] [Staatliches Veterinäruntersuchungsamt Braunschweig, Dresdenstrasse 6, D-3300 Braunschweig, Federal Republic of Germany]

116 merino sheep from 3 different areas of Algeria where there are few or no emissions were examined for Pb, Cd and As concn. in the muscle, liver and kidneys. Tabulated results (mg/kg for mean and range) were: muscle (1 location only) - Pb 0.009, 0-0.17; Cd 0.010, 0.001-0.023; As 0.002, 0.001-0.004; liver (2 locations) - Pb 0.096, 0.024-0.183 and 0.101, 0.006-0.251; Cd 0.050, 0.017-0.075 and 0.078, 0.022-0.200; As 0.007, 0.004-0.013 and 0.006, 0.002-0.010; kidney (3 locations) - Pb 0.204, 0.035-0.622; 0.224, 0.075-0.493; 0.190 (2 samples only); Cd 0.089, 0.010-0.154; 0.238, 0.042-0.535; 0.151 (2 samples); As 0.006, 0-0.025; 0.007, 0.004-0.017; 0.008 (2 samples). The Pb concn. in the livers were 3-4 times lower than those found in Bavaria [see *Fleischwirtschaft* (1979) 59, 241], but other values were not significantly

24

[Residue studies in Austria. III. Heavy metal pesticide and antibiotics residues in slaughter animals from Lower Austria.] Rückstandsuntersuchungen in Österreich. III. Untersuchungen über Schwermetall-, Pestizid- und Antibiotikarückstände in Schlachttieren aus Niederösterreich.

Jarc, H.

Wiener Tierärztliche Monatsschrift 67 (4) 133-136, 138 (1980) [6 ref. De, en] [Bundesanstalt für Virusseuchenbekämpfung bei Haustieren, Emil-Behring-Weg 3, A-1231 Vienna, Austria]

Meat, fat, liver and kidney samples of 24 cattle and 46 pigs from Lower Austria were analysed for antibiotics, chlorinated hydrocarbons, Pb, Cd and Hg contents. No antibiotics were detected by an inhibition test with *Bacillus subtilis*. Tabulated results of GLC analysis showed all pesticides to be well below the tolerance limits, though a slightly increased concn. of DDT was found in pork fat (max. 235 parts/billion fresh wt basis). AAS detn. showed overall up to 13, 29 and 11% of Pb, Cd and Hg levels resp. to be above the max. suggested by the Federal Institute of Health of the Federal Republic of Germany (0.8, 0.1 and 0.02 p.p.m. resp.). [From En Summ.] [See FSTA (1980) 12 6S937 for part II.] RM

25

[Heavy metals in aroma compounds.]

Cottalorda, A. M.; Senaux, M. S.

Rivista Italiana Essenze, Profumi, Piante Officinali, Aromi, Saponi, Cosmetici, Aerosol 61 (5) 195-201 (1979) [32 ref. Fr] [Lautier Aromatiques, Grasse, France]

This review discusses sources of trace metals in flavour compounds; toxicological problems; international standards in foods, food additives and flavours; methods of detn. for As, Cd, Pb; Codex

Alimentarius and French limits for As, Cu, Cd, Hg, Fe, Pb and Sn; FDA limits for As, Cu, Pb and Zn, Sb, Cd, F, Hg, Se and Sn; and mean annual consumption/capita in France of Cd from flavours and foods in various groups of food are appended. RM

26

[Evaluation of daily intake of Cd from food, using emission spectral analysis.] Untersuchung zur täglichen Aufnahme von Cadmium durch die Nahrung mit Hilfe der Emissionsspektalanalyse.

Barchet, R.; Wilk, G.

Deutsche Lebensmittel-Rundschau 76 (10) 348-351 (1980) [9 ref. De, en, fr] [Chem. Untersuchungsamt der Landeshauptstadt Stuttgart, 7000 Stuttgart 1, Federal Republic of Germany]

Cd was determined in 124 total daily diet samples from a hospital kitchen by an emission spectral analysis technique (detection limit 0.005 µg Cd). A table and 2 block diagrams of results are presented. The results show a very wide range of daily per capita Cd intakes from the diet, ranging from none detectable to 588.0 µg; mean daily per capita intake was 56.9 µg. Most of the daily diet samples would give weekly Cd intakes below the WHO provisional tolerable level of 400-500 µg. Reasons for the considerable differences in Cd content of the samples could not be identified; neither seasonal effects nor specific foods were implicated. AJDW

27

Lead and cadmium contamination during acid preservation of water samples.

Calabrese, E. J.; Tuthill, R. W.; Sieger, T. L.; Klar, J. M. *Bulletin of Environmental Contamination and Toxicology* 23 (1/2) 107-111 (1979) [1 ref. En] [Univ. of Massachusetts, Amherst, Massachusetts 01003, USA]

A comparison of data relating to service system water samples revealed strikingly different values for Pb and Cd values between the 1977 and 1978 studies involving 2 communities (1 with high Na concn. and 1 with low Na concn.). The elevated levels of Pb and Cd can be explained in part via the contamination of samples by the acid ampoules with Pb and Cd based paint. It is recommended that laboratories doing similar analyses noting discrepancies in analytical results should re-examine the manner in which samples were preserved. Nitric acid ampoules used for sample preservation should not contain any potential contamination especially at the 'break off' point of the ampoule. VJG

28

[Toxic heavy metals in foods.] Toxische Schwermetalle in Lebensmitteln.

Käferstein, F. K.

Zentralblatt für Bakteriologie, 1B 171 (4/5) 352-358 (1980) [8 ref. De, en] [Zentrale Erfassungs- & Bewertungsstelle für Umweltchemikalien, Bundesgesundheitsamt, Berlin]

A compilation is given of data for the Pb, Cd and Hg contents of numerous samples of a wide range of foods (including milk, eggs, meat, liver, fish, vegetables, fruit,

fruit juices, cereals, alcoholic beverages and water) in the Federal Republic of Germany; mean values and ranges are given for concn. of these 3 elements in each food studied. Max. heavy metal concn. recorded were: Pb, 9.136 p.p.m. in leafy vegetables; Cd, 4.1 p.p.m. in bovine liver; and Hg, 2.74 p.p.m. in fish. The likely total weekly intakes of Pb, Cd and Hg from foods were calculated, and found to be well below the WHO recommended limits. AJDW

29

[Voltammetric determination of toxic trace metals in wine.] Die voltammetrische Bestimmung toxischer Spurenmetalle im Wein.

Golimowski, J.; Nürnberg, H. W.; Valenta, P. *Lebensmittelchemie und Gerichtliche Chemie* 34 (5) 116-120 (1980) [17 ref. De] [Inst. Angewandte Physikalische Chem., Kernforschungsanlage, 5170 Jülich, Federal Republic of Germany]

Voltammetric methods of detn. of toxic metals (Cd, Pb, Cu, Hg, Co, Ni) in wines are described. Before analysis dissolved organic constituents of the wine samples are decomposed (and bound trace metals liberated) by UV photolysis in the presence of H_2O_2 . Detailed descriptions are given of analytical conditions for detn. of each of these metals by differential pulse stripping voltammetry. Pb, Cd and Cu may be determined using an Hg film electrode; Cu and Hg may be determined using an Au electrode; and Ni and Co may be determined using a hanging Hg drop electrode sensitized with the chelating agent dimethyl glyoxime. Data are presented for Cd, Pb, Cu and Ni concn. determined by this method in 12 German, French and Italian wines of the 1970-1977 vintage s. AJDW

30

Heavy metal contents in coastal water fishes of West Malaysia.

Babji, A. S.; Embong, M. S.; Woon, W. W. *Bulletin of Environmental Contamination and Toxicology* 23 (6) 830-836 (1979) [23 ref. En] [Dep. of Food Sci. & Tech., c/o Mussehl Hall, East Campus, Univ. of Nebraska, Lincoln, Nebraska 68583, USA]

Contents of Zn, Pb, Cd and Hg were studied in 6 spp. of fish (*Epinephelus chlostigma*, *Plotosus anguillaris*, *Sciaena russeli*, *Sillago sihama*, *Tachysurus maculatus*, and *Upeneus sulphureus*) caught around the coastal waters of W. Malaysia. Tabulated data show the concn. of the heavy metals found in the 6 spp. of fish caught at 6 locations. The overall means (p.p.m.) were: Cd, 0.03-0.05; Pb, 0.21-0.32; Zn, 2.3-6.5; and Hg, 0.08-0.10. The Zn and Hg contents for *Tachysurus maculatus* were highest (6.5 p.p.m. and 0.01 p.p.m. resp.); possibly due to their habit of searching for food in muddy silt beds. The levels of all 4 metals were found to be below the max. permissible limits set by the United States Food and Drug Administration. The results show that for all the 6 spp. of fish studied, none have accumulated levels dangerous enough to pose a health problem. VJG

31

Studies on the depuration of cadmium and copper by the American oyster *Crassostrea virginica*.

Zarogian, G. E.

Bulletin of Environmental Contamination and Toxicology 23 (1/2) 117-122 (1979) [14 ref. En]

[Environmental Res. Lab., South Ferry Rd., Narragansett, Rhode Island 02882, USA]

Investigations were carried out to determine whether treated oysters would depurate accumulated Cd and Cu when returned to cleaner water containing a natural concn. of these metals. Oysters were treated with Cd for 40 wk starting Nov., 1973 and terminating Aug. 1974. Depuration of Cd proceeded for 16 wk (Sept. to Jan.) in flowing ambient seawater. Depuration of Cu was studied for 56 wk. 5 oysters were sampled weekly from the control group (in seawater) and from the experimental groups during the depuration phase of the study. Samples were analysed by AAS for Cd and Cu, and the results were expressed as $\mu\text{g/g}$ dry wt. Data indicate that Cd was not depurated by *C. virginica* under the conditions of this experiment. No significant decrease in Cu concn. occurred in either the control or Cd treated oysters with increasing or decreasing temp. regimes. VJG

32

[Determination of cadmium in biological material by atomic absorption spectrometry.]

Zmudki, J.

Bromatologia i Chemia Toksykologiczna 13 (1) 77-81 (1980) [15 ref. Pl, en, ru] [Zaklad Farmakologii i Toksykologii Inst. Weterinarii, Pulawy, Poland]

The method involves mineralization of the sample in an electric oven at 450°C, dissolution in dil. HCl or HNO_3 , chelation with ammonium pyrrolidinodithiocarbamate, extraction into methyl isobutyl ketone and AAS at 228.8 nm. 10 samples each of pork, bovine kidneys and milk were spiked with 0.050 and 0.500 mg Cd/kg; recovery by the AAS method was 89.9-102.0%. Good agreement was reached with the official method [Gajan et al., FSTA (1973) 5 11C324], using samples of pork. The sensitivity of the method is 0.0008-0.0400 mg/kg, depending on sample size. HBr

33

[Rapid enrichment method and its use in the determination of metal traces from aqueous solutions by X-ray fluorescence.] Schnelles Anreicherungsverfahren für den Einsatz der Röntgen-Fluoreszenz-Analyse (RFA) zur Erfassung von Metallspuren aus wässrigen Lösungen.

Scheubeck, E.; Jörrens, C.; Hoffmann, H.

Zeitschrift für Analytische Chemie 303 (4) 257-264 (1980) [17 ref. De, en] [Siemens AG, Postfach 211080, D-7500 Karlsruhe 21, Federal Republic of Germany]

A rapid enrichment method is described, which allows simultaneous precipitation of several metals from aqueous solutions by diethylammonium diethyldithiocarbamate. Under special conditions the precipitate forms a thin layer on a membrane filter,

which can be used for X-ray fluorescence detn. of metal traces. It was applied to drinking water, waste water and BIOKLAV decomposition solutions from beef and pork meat, liver and kidneys. 5–100 µg of Cr, Ni, Fe, Cu, Zn, Cd, Pb, Ag, Hg and Se were precipitated from 10–500 ml of water; 1–5 µg of Hg, As, Pb and Cd were precipitated from BIOKLAV decomposition solutions. Recoveries were ≥80%. Time required for one enrichment and filtration of the precipitate is 15 min for a 100 ml sample. No special equipment is needed. [From En summ.] RM

34

[Environmental pollution by and toxicological evaluation of heavy metal (mercury, lead, cadmium) residues.] Zu einigen Fragen der Umweltbelastung und rückstandtoxikologischen Beurteilung wichtiger Schwermetalle (Quecksilber, Blei, Kadmium). Kühnert, M.

Archiv für Experimentelle Veterinärmedizin 34 (3) 339–345 (1980) [15 ref. De, en, ru] [Sektion Tierproduktion & Veterinärmed., Karl-Marx-Univ., Leipzig, German Democratic Republic]

Natural occurrence of Pb, Hg and Cd and their compounds in the environment, and the significance of contamination of foods and feeds with these metals, are discussed, together with the importance of taking natural background levels of heavy metals into account in establishing tolerances for foods. Proposed WHO tolerances for foods of animal origin are 0.1 p.p.m. for Hg and Cd, and 0.5 p.p.m. for Pb. These tolerances do not, however, take account of the possibility of all 3 heavy metals occurring in a single sample. IN

35

[Heavy metals and other toxic trace elements in the human food chain. A contribution to environmental research.] Schwermetalle und andere toxische Spurenelemente in der Nahrungskette des Menschen. Ein Diskussionsbeitrag zur Umweltforschung. Claussen, T.

Berichte über Landwirtschaft 57 (1) 105–117 (1979) [30 ref. De, en, fr] [Umweltbundesamt, Bismarckplatz 1, 1000 Berlin 33]

In calculation of limits for toxic trace elements in gaseous emissions, danger to humans is often estimated only on the basis of uptake by inhalation. Significance of contamination of soils and uptake by food plants, and direct contamination of plants by dusts, etc., is discussed with reference to a number of elements and dose/accumulation relationships. Interactions of several toxic elements are also considered. Present and future significance of toxic trace elements is discussed. DIH

36

Determination of cadmium and lead in some Egyptian fish.

Khattab, F.; Haroun, I.

Egyptian Journal of Pharmaceutical Sciences 18 (4) 455–463 (1977) [12 ref. En, ar] [Analytical Chem. Dep., Cairo Univ., Cairo, Egypt]

The following fish (i) *Tilapia nilotica* (boliti), (ii) *Clarias anguillaris* (kharmout), (iii) *Barbus anema* (benni), (iv) *Mochocus niloticus* (korkar, shal), (v) *Alestes nurse* (sardina) and (vi) *Tetraodon fabaka* (fahaka) from the River Nile were examined for Cd and Pb contamination by AAS and by the standard dithizone spectrophotometric method, to examine levels of these minerals in relation to safety. Results for (i)–(vi), resp., are: for Cd 500, 800, 88, 190, 130 and 310 parts/billion by the standard method and 520, 780, 102, 200, 135 and 295 by AAS; and for Pb 280, 1000, 80, 350, 100 and 750 by the standard method and 250, 1160, 100, 330, 90 and 725 by AAS. These high values can be attributed to the presence of factories by the river. Fish living in bottom sediments, i.e. (ii) and (vi), contained higher levels than the rest; both are predators. This indicates that certain industrial waste requires more careful monitoring and possibly restriction. LH

37

[Multiple determination of Pb and Cd in fish by electrothermal AAS after wet ashing in commercially available Teflon beakers.] Vielfach-Bestimmung von Pb und Cd in Fischen durch elektrothermale AAS nach Naßveraschung in kommerziellen Teflon-Bechern. Kruse, R.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 171 (4) 261–264 (1980) [10 ref. De, en] [Staatliches Vet. für Fische & Fischwaren Cuxhaven, Schleusenstraße, D-2190 Cuxhaven, Federal Republic of Germany]

A method for acid digestion of food samples for AAS analysis that avoids many contamination problems is described, with particular reference to fish samples. 100–250 mg homogenized sample are placed in 10 ml polytetrafluoroethylene (PTFE) beakers, the wet digestion mixture ($\text{HNO}_3/\text{HClO}_4$, 2 + 1) is added, and the beaker is covered with a PTFE lid without compression. Beakers are heated in an Al block at 130°C for 6 h, then at 250°C for a further 6 h. This allows complete evaporation to dryness. Residue is then easily soluble in HNO_3 . Graphically presented results of electrothermal AAS measurement show that matrix effects on Cd signal are minimized by optimization of the atomization temp. for the matrix. Similar results were not obtained with Pb. Lowest detection limit of the assay (based on 3 × s.d. of blank assay) corresponds to sample content of 2 ng Pb/g and 0.2 ng Cd/g. Mean contents of Pb and Cd in Baltic herring muscle (5 detn.) were 0.27 µg/g and 1.25 ng/g, resp., with corresponding s.d. of 0.014 and 0.143 and variation coeff. of 5.2% and 11.4%. DIH

38

Copper and zinc in bottom sediments and oysters, *Crassostrea virginica*, from Virginia's estuaries. Huggett, R. J.

Dissertation Abstracts International, B 38 (8) 3610:

Order no. 77-31788, 125pp, (1978) [En] [Coll. of William & Mary in Virginia, Williamsburg, Virginia, USA]

Oysters were collected from 95 stations on the western side of southern Chesapeake Bay. Analyses of oyster samples for Cd, Cu and Zn indicated that a concn. gradient existed for each of these 3 trace metals, as samples collected further upstream (lower salinities) usually contained more of the metals than those downstream. A similar gradient was observed in oyster samples collected from the Newport River estuary, N. Carolina. Bottom sediments from 2 rivers were collected and analysed for Cu and Zn by 3 chemical extraction methods followed by AAS; however the trends observed in these sediment-metals did not correlate with those in oysters from the river estuaries. AL

39

Determination of lead, copper, and cadmium in wine and beer by potentiometric stripping analysis.

Jagner, D.; Westerlund, S.

Analytica Chimica Acta 117, 159-164 (1980) [5 ref. En] [Dep. of Analytical & Marine Chem., Chalmers Univ. of Tech., S-412 96 Göteborg, Sweden]

Instrumentation and analytical procedures for direct detn. of Pb, Cu and Cd in alcoholic beverages in the concn. range 1-100 µg/l are outlined. The accuracy of the potentiometric stripping method was tested by comparison with AAS; the discrepancy was never > 15%. In repeated analyses for Pb and Cu from the same bottle of wine the relative s.d. was 4% for Pb and 6% for Cu in deoxygenated samples. Precision was much poorer (20% for both elements) in non-deoxygenated samples. The relative precision in the Cd detn. was only 30%, due to its low concn. It is concluded that the technique has considerable advantages when compared to other electroanalytical techniques. JRR

40

Some analytical aspects of lead and cadmium determination in drinking water by atomic absorption spectrophotometry.

Pande, S. P.; Pendharkar, A. V.

Journal of the Institution of Chemists (India) 52 (4) 141-144 (1980) [7 ref. En] [Nat. Environmental Eng. Res. Inst., Nagpur-440 020, India]

Possible interference by various foreign ions in the detn. of Pb and Cd by AAS was studied, especially interference due to Ca^{2+} and Mg^{2+} . Ca was found to interfere significantly in Cd estimation; this effect could be eliminated by addition of Al ions. CFTRI

41

[Heavy metals in cereals. I. Contamination of grain produced in Italy.]

Baldini, M.; Grossi, M.; Micco, C.; Stacchini, A.

Rivista della Società Italiana di Scienza dell'Alimentazione 9 (5) 299-310 (1980) [4 ref. It, en] [Istituto Superiore di Sanità, Rome, Italy]

Levels of Pb, Cr, Cu, Cd and Zn were determined by AAS in numerous samples of wheat grown in various regions of Italy in 1978. Tables and block diagrams of results are given. The max. recorded concn. of these heavy metals were (p.p.m.): Pb 1.55; Cr 1.55; Cd 3.03; Zn 47.41; and Cu 33.98. Regional variations in heavy metal

concn. in wheat are presented diagrammatically, and discussed. AJDW

42

[Studies on the accumulation of trace elements in fish. IV. Distribution of heavy metals and arsenic in yellowtail tissue.]

Yasuda, K.; Katsuki, Y.; Ueda, K.; Naoi, Y.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 29 (1) 177-181 (1978) [11 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo, 160 Japan]

Muscle, liver, kidney, pyloric caecum, digestive organs, spleen, heart, ovary and gills of eight 82-91 cm long Yellowtails were analysed for heavy metals i.e. Pb, Cd, Zn, Cu, Mn, Co, Cr, total and methyl Hg, and arsenic, by AAS and GLC. Total and methyl Hg levels were highest in muscle, caudal muscle having 30% more than white muscle; 4 fish had levels above Japanese recommended levels i.e. > 0.4 and > 0.3 p.p.m. resp. for total and methyl Hg. Cd was found at up to 1.1 p.p.m. in liver, but at < 0.1 p.p.m. generally elsewhere. Levels of other heavy metals and arsenic examined were considered as background, and presumably safe. [From En summ.] [See FSTA (1980) 12 4R221 for part III.] LH

43

[Studies on the accumulation of trace elements in fish. V. Trace elements in crustacea.]

Shimamura, Y.; Tamura, Y.; Maki, T.; Nishigaki, S.; Naoi, Y.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 29 (1) 182-189 [17 ref. Ja] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo, 160 Japan]

Concn. of Se, Hg, arsenic, Cd, Pb, Cu, Zn, Co, Cr and Mn in 8 spp. of shrimp and 6 spp. of crab from various areas of Japan are tabulated. Hg concn. in both muscle and internal organs was generally low, < 0.1 mg/kg. There was a wide variation between spp. in Se concn. of muscle, but within spp. values were fairly constant. Regional differences were observed particularly in the Hg content of snow crab, the Hg and arsenic content of kegani and Hg, Cd and arsenic contents of tiger prawn. No relationship was found between trace metal concn. and body wt. for any spp. studied. Apart from Hg, metals were found in higher concn. in internal organs than in muscle. Cd concn. in crabs tended to be higher in body than leg meat. [See preceding abstr. for part IV.] BWH

44

Trace metal and organochlorine pesticide residues in New Zealand farmed oysters: a preliminary survey.

Winchester, R. V.; Keating, D. L.

New Zealand Journal of Science 23 (2) 161-169 (1980) [32 ref. En] [Chem. Div., Dep. of Sci. & Ind. Res., Private Bag, Petone, New Zealand]

Oysters were collected from 8 sites in northern New Zealand and analysed for Fe, Cu, Mn, Pb, Cd, Cr, Zn, Se, Hg, As, Sb, and organochlorine pesticides including lindane, DDE and DDT, by AAS. A table of results is given for trace metal concn. in 17 samples of (i) farmed oysters (7 sites) and 5 samples of (ii) wild oysters (from

1 site). Mean Zn concn. exceeded the New Zealand Food & Drug Regulation limit of 40 µg/g by a wide margin (202 and 290 µg/g wet wt. for (i) and (ii) resp.); Cu and Cr levels were normal (mean concn. 20 and 31 µg/g and 0.23 and 0.45 µg/g, resp.); Cd occasionally exceeded the permitted level of 1 µg/g (highest concn. 20 and 46 µg/g in (i) and (ii) resp.) and requires further study; arsenic levels exceeded New Zealand regulations (mean concn. 1.95 and 1.45 µg/g), perhaps because of uptake from leached wood preservative from oyster racks, but they comply with As levels set by some other countries; Fe, Mn, Hg, Pb, Se and Sb levels complied with those of the rest of the world (mean concn. 59 and 34, 4.3 and 1.5, 0.04 and 0.02, 0.61 and 0.70, 0.15 and 0.25, and unstated). Pesticide residues were not a significant problem, being in non-detectable or trace amounts. LH

45

[Influence of salting on the heavy metal content of meat products.] Einfluss des Salzens auf den Schwermetallgehalt von Fleischwaren. Hecht, H.

Fleischwirtschaft 60 (10) 1806, 1808-1810, 1812-1814; 1887 (1980) [11 ref. De, en]

The Hg, Cd and Pb contents were investigated in 108 commercial samples of salts from various sources: from Bavarian deposits, sea salts, N. German salts, etc. Results, tabulated by origin, showed that the salt from Bavarian deposits contained much higher concn. of heavy metals than the other types, with mean values and ranges (parts/billion) of Hg 0.97, <0.03-8.49 (vs. 0.34, <0.03-1.5 and 0.63, <0.03-1.72 for marine and N. German salt, resp.); Cd 22.8, 2.87-71.3 (vs. 17.6, 2.9-31.8 and 3.22, <0.25 and 22.0); Pb 878, 25-3850 (vs. 83.8, 5.0-438 and <5.0, <5.0-<25.0). Means for all salt samples were 0.97, 14.4 and 473 for Hg, Cd and Pb resp. The importance of low metal contamination in the salt for ensuring low contents in meat products is emphasized; controlling manufacture and purification methods for salt from contaminated deposits is recommended. RM

46

Toxicology of aflatoxin B₁, warfarin and cadmium in young pigs.

Osuna, O.

Dissertation Abstracts International, B 41 (2) 487: Order no. 80-16567, 266pp. (1980) [En] [Univ. of Florida, Gainesville, Florida 32601, USA]

The objectives of this study were to compare the toxic effects of aflatoxin B₁ and warfarin and to determine whether an additive effect from either of these compounds occurs when Cd is present at higher than normal levels in the diets of young pigs (healthy weaned barrows of mixed breed). The pigs received 5 daily doses of aflatoxin B₁ or warfarin during the fifth wk of the study and the effects (e.g. on body wt., feed consumption, blood composition) were examined for 10 days. Cd (as CdCl₂) was provided daily for 40 days via diets containing 83 µg Cd/g. Cd concn. (µg/g) found were 42.9 in kidney, 7.92 in liver and <0.22 in muscle tissues. Results indicated that the presence of Cd in the diet inhibits the toxic effects of aflatoxin B₁ but enhances the toxic effects of warfarin. It is suggested

that Cd may block the liver microsomal enzyme system and prevent activation of aflatoxin B₁ as a toxic anticoagulant metabolite; this blocking action prevents inactivation of warfarin and thus enhances its anticoagulant effects. JA

47

The effect of low level exposure to dietary cadmium, on cadmium, zinc, copper and iron contents of selected tissues of growing lambs.

Dalgarno, A. C.

Journal of the Science of Food and Agriculture 31 (10) 1043-1049 (1980) [13 ref. En] [Rowett Res. Inst., Bucksburn, Aberdeen AB2 9SB, UK]

Pregnant Cheviot ewes were fed a grass cube diet containing (i) 0.3, (ii) 3.4 or (iii) 6.4 mg Cd/kg, and after weaning lambs were maintained on the same diets for approx. 280 days. No effects of dietary Cd on birth wt., feed intake and carcass wt. of lambs were recorded. Contents of Cd in lamb tissues were determined at slaughter; no Cd was detectable in muscles, mean contents in liver and kidney resp. were (mg/kg DM) (i) 0.119, 1.76; (ii) 4.07, 18.10; (iii) 9.11, 46.0, resp. Large variation was observed in liver contents of Cd. Increasing level of Cd in diet significantly decreased liver Cu content, and increased kidney Zn content. Tissue Fe contents were not significantly affected by Cd in the diet, except for a slight decrease in *longissimus dorsi* Fe in (iii). DIH

48

Atomic emission and atomic fluorescence spectrometry in inductively coupled plasma.

Nikdel, S.

Dissertation Abstracts International, B 41 (2) 559-560: Order no. 80-16562, 242 pp. (1980) [En] [Univ. of Florida, Gainesville, Florida 32601, USA]

Several studies are reported which examined the use of inductively coupled plasma as an excitation source in atomic emission spectrometry and atomic fluorescence spectrometry. One study involved use of an inductively coupled argon plasma as a narrow line radiation source for the excitation of atomic fluorescence in several analytically useful flames (e.g. N₂-separated air/acetylene). Detection limits for 14 elements were compared to atomic fluorescence detection limits using other radiation sources and to those of other atomic spectrometric techniques. Dominant noise sources which limit measurement precision at high and low concn. and the significance of and correction for the scatter problem are discussed. The reduction of spectral interference observed in inductively coupled plasma emission is demonstrated for the detn. of Zn in unalloyed Cu. The technique was also applied to the detn. of Zn in fly ash, Cd and Zn in simulated fresh water, and Cu and Zn in orange juice. JA

49

Evaluating home plumbing corrosion problems.

Hoyt, B. P.; Kirmeyer, G. J.; Courchene, J. E.

Journal American Water Works Association 71 (12) 720-725 (1979) [9 ref. En] [Seattle Water Dep., Seattle, Washington, USA]

Plumbing corrosion by Seattle water supplies was studied. Problems caused are: aesthetic, viz. rusty water, red or blue staining, and metallic tastes; economic; and health. Means of documenting incidences and severity of such corrosion are considered. Amount of metal leached from pipes was examined in relation to water quality characteristics. Pb, Cd, Cu, Zn, Fe and Mn were commonly found in tap waters of an aggressive nature. Seattle water from Told and Cedar rivers had, resp.: dissolved O_2 content $> 95\%$ saturation for both; alkalinity, 2.5 and 16 mg/l (as $CaCO_3$); pH, 6.0 and 7.1; hardness, 8 and 21 mg/l (as $CaCO_3$); silica, 4 and 8 mg/l (as SiO_2); specific conductance, 26 and 52 $\mu S/cm$. LH

50

[Atomic absorption spectrophotometry of metals in sugars using solvent extraction with sodium diethyldithiocarbamate/methyl isobutyl ketone.] Saito, S.

Proceedings of the Research Society of Japan Sugar Refineries Technologists [Seito Gijutsu Kenkyukai-shi] 27, 19-23 (1977) [10 ref. Ja, en]

Detn. of heavy metals by AAS is generally performed after pre-treatment of the samples by either dry ashing or wet combustion; such pre-treatment has various disadvantages, i.e. it is time-consuming, and subject to interference by impurities in the samples and reagents. This study explored the possibility of omitting pre-treatment in the detn. of Cu, Pb, Cd and Cr in sugars by AAS, and instead using solvent extraction, sodium diethyldithiocarbamate being utilized as a chelating agent. The procedure involved adding 10 ml acetic acid-ammonium acetate buffer, 2 ml of 25% rochelle salt solution, 5 ml of 1% sodium diethyldithiocarbamate and 10 ml methyl isobutyl ketone to 40 ml of a 10-20% (w/v) sugar solution, followed by shaking for 4 min, allowing the mixture to stand until the layer of methyl isobutyl ketone has separated and then analysing this separated layer by AAS. The method was successfully applied to detn. of the 4 heavy metals in sugars. [From En summ.] JA

51

[Cd in horse meat and internal organs.]

Renon, P.; Soncini, G.; Cantoni, C.

Archivio Veterinario Italiano 31 (1/2) 5-7 (1980) [11 ref. It, en] [Istituto di Ispezione degli Alimenti di Origini Anim., Univ. degli Studi di Milano, Milan, Italy]

8 samples of muscle and 12 samples each of spleen, liver and kidney from horses were analysed for Cd by AAS. Tables of results are given. Mean values (with ranges in parentheses) for Cd concn. were (p.p.m.): meat 0.133 (0.029-0.395); spleen 0.364 (0.045-1.280); liver 6.578 (1.940-9.306); and kidney 28.064 (15.180-45.925). AJDW

52

[Effect of location and age on the lead and cadmium contents of cattle kidneys.] Über den Blei- und Cadmium-Gehalt in Rindernieren in Abhängigkeit von zwei verschiedenen Standorten sowie vom Lebensalter.

Agthe, O.; Dickel, H.

Archiv für Lebensmittelhygiene 31 (5) 169-172 (1980) [10 ref. De, en] [Staatliches Veterinäruntersuchungsamt Oldenburg, Philosophenweg 38, 2900 Oldenburg, Federal Republic of Germany]

219 samples of kidney from cattle aged < 1 to 8 yr, from 2 emergency-abattoirs in (i) a non-industrial and (ii) an industrial area, were examined for Pb and Cd contents. Results showed mean Pb contents of 0.06 and 0.25 p.p.m., resp. in samples from areas (i) and (ii) ($P < 0.001$), and no significant effect of age. Cd contents did not differ significantly with the location but were linearly related to the age of the animals. ($P < 0.001$). The tolerance level for Pb (0.8 p.p.m.) was exceeded in 3 samples from (ii); Cd tolerance (1.0 p.p.m.) was exceeded in 20% of samples from (i), 46% of samples from (ii) and in all animals > 4 yr of age. RM

53

[Harmful metal contamination in foods of animal origin.] Grundbelastung von Lebensmitteln tierischer Herkunft mit Schadmetallen.

Holm, J.

Fleischwirtschaft 60 (12) 2227-2229 (1980) [16 ref. De, en] [Staatliches Veterinäruntersuchungsamt Braunschweig, Dresdenstraße 6, D-3300 Braunschweig, Federal Republic of Germany]

Pb and Cd contents are presented from detn. in kidney and liver samples of large numbers of farm animals, poultry and game from contaminated and uncontaminated areas, as well as Pb contents in blood samples from approx. 4000 cattle, in relation to sources of pollution and mean Pb contamination in blood, liver and kidneys of cattle in a pure air district and a polluted area. Tabulated data suggest that Pb contents are very dependent on the environment (traffic density, polluted area), while Cd contamination is largely unaffected. Max. Pb levels were 0.92 mg/kg fresh matter in blood, 4.94 in liver and 12.1 in kidney; the max. ratio of metal contamination in organs of animals from unpolluted vs. polluted areas were 1:4-1:10 for Pb. The ratio of Pb in blood:Pb in liver was about 1:10 in 5 herds, suggesting that early recognition of Pb contamination in live animals could be used to monitor polluted areas (subject to further research). RM

54

[Effects of Cd concentration in the soil on yield and Cd content of various plants.] Der Einfluss von Cadmium im Boden auf den Ertrag verschiedener Pflanzenarten und deren Cadmiumgehalt.

Kloke, A.; Schenke, H.-D.

Zeitschrift für Pflanzenernährung und Bodenkunde 142 (2) 131-136 (1979) [8 ref. De, en] [Biol. Bundesanstalt, Königin-Luise-Strasse 19, 1000 Berlin 33]

Studies on the growth and Cd content of various plants grown in soil containing 0-250 mg Cd/kg are described. Graphs are given showing yields of various plants, and also for the Cd content of edible and inedible parts of tomato, green bean, oat and carrot

plants. The results show Cd accumulation in the edible parts to be appreciably lower than in the leaves, straw etc. The highest Cd concn. (approx. 60 mg/kg DM) were recorded for carrots and oats grown in soil containing 250 mg Cd/kg. Cd concn. in tomatoes and green beans were appreciably lower (≤ 20 mg/kg DM). AJDW

55

Cadmium and lead content of soybean products.

Braude, G. L.; Nash, A. M.; Wolf, W. J.; Carr, R. L.; Chaney, R. L.

Journal of Food Science 45 (5) 1187-1189, 1199 (1980) [21 ref. En] [FDA, 200 C Street S.W. Washington, DC 20204, USA]

Soybeans grown on sludge-amended soil high in Cd content were analysed for Cd and Pb, then fractionated to simulate industrial food processing. Of these fractions, oil retained the least Cd, which accumulated in the protein-enriched fractions. Protein products prepared in the laboratory by simulated industrial processes showed no practical differences in Cd levels. Commercial soybean products for human consumption [defatted flour, concentrates, isolates] obtained from manufacturers and markets showed no elevated Cd levels. Pb levels were high in isolated instances, presumably from contamination during processing. Cd in high-Cd soybeans is retained by protein products consumed by humans; increased Cd application to soils may be hazardous to humans. However, soybean products presently being marketed do not contain excessive Cd or Pb. IFT

56

[Transfer of lead and cadmium from milk to cheese.]

Hayashi, M.; Ito, O.; Akuzawa, R.; Oishi, H.

Medicine and Biology, Japan [Igaku to Seihutsugaku] 100 (1) 23-25 (1980) [6 ref. Ja] [Dep. of Public Health, Hyogo Coll. of Med., Nishinomiya, Japan]

Pb and Cd were added to pasteurized cows' milk to give concn. of 1, 10 and 50 mg/kg, and the milk was made into cheese. In total 1.9 l milk produced 160-180 g cheese. At the 3 concn., resp., transfer of Pb to cheese was 38, 33 and 21%, and transfer of Cd was 22.6, 31.0 and 33.6%. Actual concn. in cheese was 4.07, 37.56 and 126.20 mg Pb/kg and 2.54, 35.20 and 190.60 mg Cd/kg. It is thought that at low concn. Pb is transferred into cheese with fat whereas Cd binds to whey proteins. At high concn. excess Pb is lost whereas excess Cd is transferred to cheese. BWH

57

Heavy metal retention in tissues of cattle fed high cadmium sewage sludge.

Johnson, D. E.; Kienholz, E. W.; Baxter, J. C.; Spangler, E.; Ward, G. M.

Journal of Animal Science 52 (1) 108-114 (1981) [21 ref. En] [Anim. Sci. Dep., Colorado State Univ., Fort Collins, Colorado 80523, USA]

A diet containing 11.5% (DM basis) of a moderately high Cd sewage sludge was fed to 6 Hereford steers for 106 days to simulate a high sludge intake from sludge-

amended soils. At mean live wt. 460 kg, the steers were slaughtered, and liver, kidney, bone, muscle, lung, brain and spleen tissues were collected for heavy metal dem.; tissues were also collected from 6 control steers fed the same diet with no sludge. The sludge-fed cattle had slightly higher feed intake, but the gain was lower than that of control cattle. Sludge had approx. zero energy value and was acting as a dietary diluent. The sludge metal content (p.p.m. dry basis) was Cd 98, Hg 18, Pb 466, Cu 1733, and Zn 1733. Addition of sludge increased metal contents of the feedlot diet to 30-100 \times that of the control. Retention of heavy metals in the total animal from sludge ingestion averaged 0.090%, 0.06% and 0.3% for Cd, Hg and Pb; no retention was noted for Cu and Zn. These low fractional retentions increased tissue Cd, Hg and Pb concn. of liver and kidney tissues by 5-20 fold. Estimates of levels that would enter the human diet from average beef tissue consumption if all feedlot steers were fed sludge are presented for Cd, Hg and Pb. The data indicate that cattle are a moderately effective screen against the entry of these potentially toxic metals into the human diet. AS

58

Elemental content of vegetables and apple trees grown on Syracuse sludge-amended soils.

Furr, A. K.; Parkinson, T. F.; Elfving, D. C.; Bache, C. A.; Gutenmann, W. H.; Doss, G. J.; Lisk, D. J.

Journal of Agricultural and Food Chemistry 29 (1) 156-160 (1981) [23 ref. En] [Nuclear Reactor Lab., Virginia Polytech. Inst. & State Univ., Blacksburg, Virginia 24061, USA]

2 successive crops of peppers, kohlrabi, lettuce, peas, spinach, sweet potatoes, and turnips were grown in pots of control and municipal sludge-amended acid and neutral soils. 2 commercial apple cv. were also cultured. Cd, Cu, Ni and Zn were higher in the sludge-grown crops. Cd, Ni and Zn were usually higher in vegetable crops grown on the sludge-fortified acid soil. Cu was higher in the vegetables grown on the neutral soil-sludge mixture. Ni and Zn generally decreased in concn. in sludge-grown vegetable crops and apple trees during the 2nd yr of growth. There was not a consistent varietal or soil pH effect as regards heavy metals in apple trees. Cu and Zn tended to concentrate in apple twigs while Ni and Pb concentrated in apple leaves. Metal residues in apple fruit were comparatively low. AS

59

High concentrations of some heavy metals in tissues of the Mediterranean octopus.

Miramand, P.; Guary, J. C.

Bulletin of Environmental Contamination and Toxicology 24 (5) 783-788 (1980) [25 ref. En] [Int. Lab. of Marine Radioactivity, IAEA, Musée Oceanographique, Monaco]

54 samples of octopus (*Octopus vulgaris*) were collected near the coast of Monaco, and their tissues analysed for Cd, Cu, Fe, Mn, V and Zn by flame AAS. Results are tabulated. The hepatopancreas was found to be the major site for concn. of 4 of the 6 elements measured, Mn and V being the 2 exceptions. The hepatopancreas contained between 32 and 98% of the whole animal content of Cd, Cu, Fe and Zn. Mn tended

to be most concentrated in the kidney, although its distribution throughout the animal was fairly uniform. V concn. in the branchial hearts was $6 \times$ higher than that in the hepatopancreas and $50\text{--}100 \times$ higher than that in the other tissues. VJG

60

[Contents of heavy metals in foods produced in Hokkaido.]

Sato, C.; Yamamoto, I.; Osanaga, H.; Sato, Y.
Report of the Hokkaido Institute of Public Health [Hokkaidoritsu Eisei Kenkyusho Ho] No. 30, 87–88 (1980) [Ja]

Contents of As, Pb, Cd, Cu, Zn, and Mn are tabulated for wheat, azuki beans, potato, burdock, radish leaves and root, spinach, chinese cabbage, pumpkin, cucumber, tomato, strawberries, apples, pears, grapes, shiitake mushrooms, nameko and konbu (172 samples) produced in Hokkaido. BWH

61

[Determination of Zn, Cu, Cd and Pb in water by means of acetylene/air flame AAS.] Zur Bestimmung von Zn, Cu, Cd und Pb in Wässern mittels Atomabsorptionsspektrometrie in der Acetylen-Luft-Flamme.

Schumann, H.

Zeitschrift für die Gesamte Hygiene und ihre Grenzgebiete 26 (10) 706–710 (1980) [50 ref. De, en, ru] [Hygiene-Inst., Martin-Luther-Univ., Halle-Wittenberg, German Democratic Republic]

Use of AAS for detn. of Zn, Cu, Cd and Pb in water requires a preliminary concentration process. The most frequently used concentration methods are extraction, ion exchange and distillation; distillation is the simplest, but also results in concentration of other constituents which may influence the intensity of the absorption signal. These matrix effects were evaluated in a multi-factor programme which took into consideration 8 cations and anions; they may be eliminated by the use of calibration curves. Recoveries from spiked samples were: Zn 92%, Cu 98%, Cd 92% and Pb 115%; corresponding variation coeff. were 1.8%, 2.8%, 4.1% and 5.1% resp. IN

62

Elemental composition of globoid crystals in protein bodies of wheat grain grown on soil treated with sewage sludge.

Spitzer, E.; Webber, M.; Lott, J. N. A.

Canadian Journal of Botany 59 (3) 403–409 (1981) [38 ref. En] [Dep. of Biol., McMaster Univ., Hamilton, Ontario, Canada L8S 4K1]

Wheat grain grown on soil treated with a heavy application rate of sewage sludge exhibited higher Fe, Zn, Cu, and Cd contents than did wheat grain grown on an unfertilized control treatment. The sludge supplied more than the max. amounts of Zn, Cu, Cd, and Pb recommended for addition to Ontario agricultural lands. Globoid crystals, which are inclusions in protein bodies, are the major mineral storage component of wheat grain. The elemental composition of globoid crystals in wheat grain grown with and without sludge treatment was determined using energy dispersive X-ray (EDX) analysis. Globoid crystals from sludge-

treated and control grains exhibited similar elemental compositions with the following exceptions. When comparing sludge-treated grains versus the controls: more globoid crystals in the aleurone layer farthest from the peduncle contained Ca; more coleoptile mesophyll globoid crystals contained Ca, Mn, and (or) Fe; some globoid crystals in the young foliage leaves contained Mn; and some globoid crystals in the stele of the radicle contained Ca. The globoid crystals exhibited no tendency to accumulate toxic metals supplied by the sludge indicating that the mineral storage system in wheat is remarkably specific despite varying soil conditions. AS

63

[Distribution of Pb and Cd in wheat plants grown on polluted soils.]

Il'in, V. B.; Stepanova, M. D.

Agrokhimiya No. 5, 114–119 (1980) [11 ref. Ru] [Inst. Pochvovedeniya i Agrokhimii SO AN SSSR, Novosibirsk, USSR]

Spring wheat var. Novosibirskaya 67 was grown on 2 types of soil, each spiked with $\text{Pb}(\text{NO}_3)_2$ or CdSO_4 . Pb and Cd contents were then determined by AAS in the leaves and roots (at the tillering stage) and in fully ripe grain, and contents were in the following order: roots > leaves > grain (data tabulated). A max. permissible Pb concn. of 4–5 mg/kg was recommended for leaves of the wheat plant during grain production; higher concn. caused toxicosis in the plants. This concn. does not however apply when the green parts of the plant are used for animal feeds. RAW

64

[Evaluation of mercury, cadmium and lead accumulation in commercial fish from the public health viewpoint.]

Petukhov, S. A.

Rybnoe Khozyaistvo No. 7, 70–71 (1980) [Ru] [VNIRO, USSR]

On the basis of the average fish consumption in the USSR in the yr 1970–1977 (17.1 kg per head of population) and on the basis of the average content of heavy metals in fish, it was calculated that the consumption of Hg amounted to 39.2 μg representing 13.1% of the permitted consumption, that of Cd to 21 μg , which is 5.3% of the amount permitted, and 140.7 μg of Pb representing 4.7% of the permitted level. It was established that even in the case of higher consumption of fish products no health danger threatened but caution was recommended with respect to the purity of the inside of tanks for fish transport and storage. STI

65

[Cadmium in organs and tissues of slaughter cattle.]

Kacmar, P.; Ogurcakova, K.; Fedorova, O.; Samo, A.
Veterinarni Medicina 25 (11) 663–668 (1980) [12 ref. Sk, ru, en, de] [Vysoka Skola Vet., 04181 Kosice, Czechoslovakia]

Cd was determined by AAS in 39 samples of liver, 39 of kidney, 45 of muscle tissue, and 32 of bone of slaughter cattle, aged 3–14 yr, from a number of localities in East Slovakia. The mean values were resp.: 0.355, 0.793, 0.317, and 0.845 mg/kg. The contents in

animals classified by age into 3-4 yr and 8-12 yr categories were resp. with numbers of samples in parentheses (mg/kg): liver, 0.42 (11) and 0.35 (14); and kidney, 0.63 (10) and 0.95 (14); age differences in Cd concn. in muscle tissue were slight. Local environmental effects were reflected in Cd contents of bone, 7 samples from cattle aged 3-4 yr in non-industrial localities containing 0.55 mg/kg vs. 0.90 mg/kg for 7 corresponding samples from industrial localities. SKK

66

[Natural content of cadmium in foods.]

Zimakov, I. E.

Voprosy Pitaniya No. 2, 57-61 (1980) [17 ref. Ru, en] [Vses. Nauchno-issled. Inst. Vet. Sanitarii, USSR]

The natural Cd content of foods was determined by the multiple isotope dilution method using a radioisotope without a carrier [see FSTA (1978) 10 11A666]. Average Cd contents were comparatively low, ranges being (mg/kg) 0.009-0.023 in various meats, 0.012-0.035 in fish, 0.010-0.017 in cereals, and 0.013-0.054 in vegetables [all results lower than the max. permissible levels defined by WHO]. These results were compared with published results obtained using AAS methods (data tabulated); Cd contents by AAS were 0.034 ± 0.031 in butter and 0.028 ± 0.015 in eggs. Significance of the results with reference to total Cd intake is discussed. RAW

67

[Contamination of foods and feeds in the Erfurt district with Pb and Cd. II. Contamination of crops in the vicinity of a source of Pb pollution and a control area.] Untersuchungen zur Kontamination von Lebens- und Futtermitteln ausgewählter Gebiete des Bezirkes Erfurt mit Blei und Cadmium. II. Zur Belastung pflanzlicher Anbauprodukte im Bereich eines Bleiemittenten in bezug auf ein Vergleichsgebiet. Engst, R.; Beckmann, G.; Lauterbach, K.; König, R. *Nahrung* 25 (2) 175-184 (1981) [52 ref. De, en, ru] [Zentralinst. für Ernährung, Potsdam-Rehbrücke, German Democratic Republic]

Using the inverse voltammetry method described in part I [see FSTA (1980) 12 5C254] 126 feedstuff samples and 86 grain samples (spring and winter barley, winter wheat, oats) were examined for Pb and Cd contents. Contamination levels were directly dependent on distance from the source of pollution (a Pb processing plant): 11 of 55 samples from the polluted area contained > 0.5 mg Pb/kg fresh matter. As expected, there was no correlation between Cd and Pb contents. Results were compared with samples from a control area (39 feed and 31 grain samples). Contamination primarily resulted from air pollution and not from the soil. Conclusions are drawn on the agricultural use of the soil in Pb-polluted areas. Studies on the food chain are to be continued. IN

68

[The agricultural significance of heavy metals.] Die pflanzenbauliche Bedeutung von Schwermetallen. Kampe, W.

Verbraucherdienst 25 (12) 267-272 (1980) [1 ref. De] [Landwirtschaftliche Untersuchungs- & Forschungsanstalt, Speyer, Federal Republic of Germany]

Aspects discussed include: the present situation in relation to heavy metals in foods; toxicity of heavy metals; dietary requirement for low concn. of some heavy metals; sources of contamination (with reference to heavy metal concn. in the soil, air and sewage sludge, proprietary fertilizers, and pesticides); differences in heavy metal uptake between different plants and different spp. of edible fungi; practical implications; and the potential for reduction of heavy metal concn. occurring in foods. AJDW

69

Analysis of trace metals in orange juice. [Lecture] McHard, J. A.; Foulk, S. J.; Jorgensen, J. L.; Bayer, S.; Winefordner, J. D.

ACS Symposium Series 143, 363-392 (1980) [70 ref. En] [Dep. of Chem., Univ. of Florida, Gainesville, Florida 32611, USA]

Methods for detn. of mineral elements in orange juice are presented together with some comparative data showing the similarities and differences which occur especially between orange juices from Florida and Brazil. Some statistical representations are given to show how these differences may be used as fingerprints of geographical origin of the juices. [See FSTA (1981) 13 11]587.] AL

70

[Chemical form of copper in soybeans. I.

Ultrafiltration of copper and cadmium in soybeans.] Tanaka, R.; Yoshida, S.; Kashimoto, T.

Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 21 (4) 243-246 (1980) [4 ref. Ja, en] [Osaka Prefectural Inst. of Public Health, 3-69, Nakamichi 1-chome, Higashinari-ku, Osaka, Japan]

As part of a series of studies to clarify the chemical form of heavy metals in food, the interaction between Cu (and Cd) and the water-soluble fraction of soybeans was investigated. Of the total Cu and Cd in soybeans, 60% of each was extracted as water-soluble supernatant by ultracentrifugation ($\times 105\,000G$). The effect of pH on the extraction of the water-soluble fraction was studied. The amounts of Cu and Cd extracted at pH 4 or 5 were minimal. At pH 4 or 5, the amount of total N and the absorbance at 280 nm were also min. Cu and Cd may bind to a protein(s) which precipitates at its isoelectric point, pH 4 or 5. Ultrafiltration of the water-soluble fraction was carried out. Approx. 90% of Cd in the water-soluble fraction was retained in the highest mol. wt. fraction ($> 40\,000$). However, Cu was found in various mol. wt. fractions (21% in mol. wt. $> 40\,000$, 28% in mol. wt. 40 000-10 000 and 50% in mol. wt. $< 10\,000$). AS

71

Cadmium in Swedish winter wheat. Regional differences and their origin.

Andersson, A.; Pettersson, O.

Swedish Journal of Agricultural Research 11 (2) 49-55 (1981) [26 ref. En] [Dep. of Soil Sci., S-750 07 Uppsala, Sweden]

Studies were conducted on Cd concn. in winter wheat of several var. from 2 regions of Sweden: (i) 49 samples from western and southern Skane and (ii) 58 samples from the region of Uppland-Västmanland immediately north of Lake Mälaren. Most of the samples studied were from the 1979 harvest, the rest from the 1978 harvest. All samples were analysed for Cd and Zn, and 40 (i) samples were also analysed for Pb. Graphs and block diagrams of results are given. Mean values and ranges for Cd concn. were (ng/g dry wt.): (i) 96 and 53-171; and (ii) 61 and 28-132. Average Zn concn. in wheat grain from (i) and (ii) resp. were 28.3 and 31.3 µg/g dry wt. The Cd:Zn ratio in wheat grain was 1:503 for (i) and 1:813 for (ii). Annual and cv. differences in Cd concn. in wheat concn. are discussed, together with factors responsible for the regional differences. Pb concn. were <100 ng/g dry wt. in (i) samples. AJDW

72

Cadmium effects from phosphorus fertilization in field experiments.

Andersson, A.; Hahlin, M.

Swedish Journal of Agricultural Research 11 (1) 3-10 (1981) [33 ref. En] [Dep. of Soil Sci., S-750 07 Uppsala, Sweden]

Effects of Cd present as an impurity in P fertilizers on Cd concn. in soils and in crops are discussed. Experimental data are presented for barley grown under various P fertilization regimes ranging from 0 to 45 kg P/ha annually, or 30 or 270 kg P/ha every 6 yr. Cd concn. in the grain were significantly higher for the 45 kg P/ha yr treatment (16.0 ng Cd/g grain dry wt. and the 270 kg P/ha every 6 yr treatment (16.9 ng Cd/g grain dry wt.) than the other treatments (12.4-12. ng Cd/g grain dry wt.). Regressions relating grain Cd to fertilizer application and the total, soluble and exchangeable Cd levels in the soil are presented. AJDW

73

Determination of heavy metals in sea water and in marine organisms by flameless atomic absorption spectrophotometry. XIII. Correspondence and some possible sources of error in an intercalibration of cadmium.

Sperling, K.-R.; Bahr, B.

Zeitschrift für Analytische Chemie 306 (1) 7-12 (1981) [15 ref. En, de] [Biol. Anstalt Helgoland, Wüstland 2, D-2000 Hamburg 55, Federal Republic of Germany]

Results are presented of an intercalibration (collaborative test by 10 laboratories) of Cd detn. by flameless AAS in biological materials (herring eggs, whole shrimps, trout muscle). The philosophy of this kind of investigation is discussed. The goal and result of

the investigation was a correspondence of the results within an acceptable range (optimum range 0.2-5 µg/l). The main reason for severe deviations was identified as contamination during further handling; variations were due to operators, not to the equipment. Repeated comparisons after elimination of systematic errors showed satisfactory agreement between results. [See FSTA (1981) 13 2A92 for part XII] RM

74

[Investigations in Hessian beers. VII. Determination of trace elements in bottom-fermented 'Voll' beers.] Untersuchungen an hessischen Bieren. VII. Ermittlung des Gehalts einiger Spurenelemente in untergärigen Vollbieren.

Thalacker, R.

Monatsschrift für Brauerei 33 (10) 401-405 (1980) [De en, fr] [Staatliches Chem. Untersuchungsamt, D-6300 Giessen, Federal Republic of Germany]

Data are presented for concn. of Cd, Pb, Cu and Hg (determined by flameless AAS) in a total of 55 samples of bottled export and Pilsener beers from 29 breweries in Hesse. Mean values with ranges were (mg/l): Cd 0.004 and 0.001-0.006; Pb 0.044 and 0.02-0.08; and Cu 0.085 and 0.04-0.35; all samples contained <0.0005 mg Hg/l. None of these values present any health hazard. [See *Monatsschrift für Brauerei* (1978) 31, 344 for part VI.] TUB-IGB

75

Extension of analytical calibration curves in atomic absorption spectrometry.

Harnly, J. M.; O'Haver, T. C.

Analytical Chemistry 53 (8) 1291-1298 (1981) [18 ref. En] [Beltsville Human Nutr. Res. Cent., USDA, Beltsville, Maryland 20705, USA]

Wavelength modulation with a continuum source and a high-resolution polychromator permits intensity measurements to be made at predetermined intervals across the analyte absorption profile. From these intensity measurements a series of absorbances can be computed from a single atomization. The method is described and its application to analysis of trace metals in orange juice is mentioned. AL

76

Spectrophotometric studies on the complexes of metal ions with caramel. (In 'Proceedings of the Forty Fourth Annual Convention' [see FSTA (1981) 13 12L847]) [Lecture]

Agarwal, S. K. D.; Gupta, V.

G9-G14 (1980) [En] [Nat. Sugar Inst., Kanpur-208 017, India]

Spectrophotometric evidence has been produced to show that caramels interact with metallic ions such as Cu²⁺, Cd²⁺, Ni²⁺, Co²⁺, and Zn²⁺ to form complexes. This appears to be the first study on complex formation by metals with substances of high mol. wt. CFTRI

77

[Polarographic determination of heavy metals in milk samples.]

Eder-Trifunovic, J.; Kozar, S.; Trifunac, M.

Prehrambeno Tehnoloska Revija 17 (1) 25-27 (1979)

[6 ref. Sh, en][Zavod za Analiticku Kemiju, Tehnoloski Fak., Zagreb, Yugoslavia]

Mean values for 3 series of 5 samples each of market milk determined using a Southern Harwell MK II polarograph after wet-ashing were resp. ($\mu\text{g/l}$): Cd 0.56, 0.56 and 0.56, Pb 5.8, 2.0 and 13.7, and Cu 51.8, 31.8 and 19.0. Equivalent values for chocolate milk were Cd, 0.22, 0.56 and 1.30, Pb 5.4, 8.3 and 6.2, and Cu 356, 495 and 445. The high content of Cu in chocolate milk is ascribed to leaching out of the metal from the Tetrapak container. SKK

78

[Accumulation of Cd in broiler tissues.] Cadmium-Aufnahme in Gewebeteilen von Masthähnchen.

Grote, B.; Speck, J.

Archiv für Lebensmittelhygiene 32 (1) 24-26 (1981)

[18 ref. De, en][Geochemisches Inst. der Univ., Goldschmidtstrasse 1, 3400 Göttingen, Federal Republic of Germany]

Cd accumulation was monitored daily in the breast and thigh meat, liver, kidneys and bones of 50 broilers given a daily dose of 10 mg Cd for 15 days and in the eggs of laying hens given 10 mg of Cd for 7 wk, as well as in the tissues of the hens slaughtered after 7 wk. Daily Cd detn. by flameless AAS showed that Cd was rapidly absorbed into tissues, especially in liver and kidneys: highest concn. were 18 p.p.m. in kidneys, 11 p.p.m. in liver, while concn. in breast and thigh meat and bones were around 1 p.p.m. Only low concn. were observed in the eggs, i.e. 0.03 p.p.m. in yolks, 0.02 p.p.m. in whites, and 0.025 p.p.m. in shells. Cd concn. in the tissues of the broilers were unchanged 4 wk after the administration of Cd was stopped, showing that even brief exposures cause accumulation of the toxic metal in edible tissues. RM

79

[Accumulation of Cd in fattening pigs.] Ein Beitrag zur Aufnahme und Rückstandsbildung von Cadmium bei Mastschweinen.

Crössmann, G.

Archiv für Lebensmittelhygiene 32 (1) 21-24 (1981)

[11 ref. De, en][Landwirtschaftliche Untersuchungs- und Forschungsanstalt Joseph-König. Inst., Landwirtschaftskammer Westfalen, Kanalstrasse, 240, 4400 Münster/Westfalen, Federal Republic of Germany]

400 fattening pigs were fed for 6-7 months (from 30 to about 100 kg) with 13 commercial complete feeds and 3 experimental mixtures based on grain or tapioca. The Cd uptake from these "naturally" contaminated feeds and its accumulation (carry-over) in kidneys, liver and meat (*longissimus dorsi*) were investigated. All the tested feeds contained 0.06-0.29 mg Cd/kg DM. Results, shown graphically and in tables, revealed mean Cd concn. in kidneys of 188 ± 56 parts/billion (p.p.b.) on fresh wt. (max. 600 p.p.b.); the mean value for liver was

45 p.p.b., (max. 139 p.p.b.). No Cd was detected in meat (detection limit 10 p.p.b.), even on a diet containing 0.29 mg Cd/kg. The results show that current feeding practice for fattening pigs in the Federal Republic of Germany does not represent a health hazard with regard to carry-over of Cd. RM

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FAB 37

CADMIUM IN FOODS

SELECTED FROM VOLUME **14**

FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

under the direction of:-

Commonwealth Agricultural Bureaux, Farnham Royal, Slough; Gesellschaft für Information und Dokumentation, Frankfurt am Main; Institute of Food Technologists, Chicago; Centrum voor Landbouwpublikaties en Landbouwdocumentatie (Pudoc), Wageningen

INTRODUCTION

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Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journals, patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES

EDITOR

1

[Self-protection of consumers: avoidance of the uptake of excess amounts of heavy metals from food.] Möglichkeiten des Selbstschutzes der Verbraucher vor der Aufnahme vermeidbarer Schwermetallmengen über Lebensmittel.

Käferstein, F. K.; Klein, H.

Bundesgesundheitsblatt 23 (3) 32-35 (1980) [8 ref. De, en] [Zentrale Erfassungs- und Bewertungsstelle für Umweltchemikalien (ZEBS) des Bundesgesundheitsamtes, Postfach, 1000 Berlin 33]

High Cd levels averaging approx. 1 mg/kg fresh wt. were found in kidneys of swine and cattle. One kidney portion would contain 30% of the WHO max. tolerated weekly intake. Although the relevance of frequent consumption of kidneys to health from the toxicological viewpoint has not been resolved, it is recommended that kidneys from cattle and swine only be consumed infrequently (at 2-3 wk intervals). Hg levels in the liver of hares were found to be clearly in excess of those found in other foods commonly considered to contain high Hg levels, e.g. fish, non-cultured mushrooms, edible offals. Consumption of hare liver is thus not recommended. Common culinary preparations such as cleaning and washing may reduce the Pb content of fruit and vegetables by up to 50%; such measures are recommended before consumption of any fruit and vegetables. [From En summ.] JRR

2

[Heavy metal intake from food.]

Schwermetallbelastung durch Lebensmittel. [Lecture] Käferstein, F. K.

Landwirtschaftliche Forschung, Sonderheft No. 36, 316-321 (1980) [7 ref. De, en, fr] [ZEBS, Bundesgesundheitsamt, D-1000 Berlin 33]

The intake of Pb, Cd and Hg by the German population is reviewed. Foods (including drinking water) are important sources of heavy metal intake. Using a model based on the 'Composite method', the average adult intakes of Pb, Cd and Hg in the Federal Republic of Germany were calculated to be about 40%, 70% and 35% resp. of the WHO provisional tolerable levels. [See FSTA (1982) 14 1A23.] RM

3

[Contamination of plants with heavy metals.]

Schwermetallkontaminationen bei Pflanzen. [Lecture] Kampe, W.

Landwirtschaftliche Forschung, Sonderheft No. 36, 322-335 (1980) [28 ref. De, en, fr] [Landwirtschaftliche Untersuchungs- & Forschungsanstalt Speyer, Obere Langgasse 40, D-6720 Speyer, Federal Republic of Germany]

Health hazards due to heavy metal contamination of crops are reviewed, with sections on sources of contamination, contamination factors (transfer from soils into plants), and decontamination (effects of technological treatment). Heavy metal contents currently measured in plant material are 0.002-0.106 mg/kg for Cd, 0.004-0.751 for Pb, 0.001-0.016 for Hg. Total diet studies using moderately contaminated products (0.049 mg/kg Pb, 0.016 Cd, 0.001 Hg) suggested a weekly consumption of 118, 39 and 3.2 µg/person (vs. FAO/WHO tolerances of 3.5, 0.525 and 0.350 mg/wk resp.). [See FSTA (1982) 14 1A23.] RM

4

[Relation between location and heavy metal contents of vegetables.] Zusammenhang zwischen Standort und Schwermetallgehalt in Gemüse. [Lecture]

Venter, F.

Landwirtschaftliche Forschung, Sonderheft No. 36, 336-342 (1980) [26 ref. De] [Tech. Univ. München, D-8050 Freising-Weihenstephan, Federal Republic of Germany]

Heavy metal analyses in vegetables and corresponding soils from different growing areas showed that heavy metal concn. in vegetables was generally dependent on location of production, although the metal contents in the plants were not clearly affected by relatively low contents in the soil. Addition of sewage sludge to sandy and loamy soils in pot experiments significantly increased the concn. of EDTA-soluble heavy metals in soils and plants; this effect varied between species and was particularly high in lettuce. In all the vegetable species, the metal concn. were highest in the leaves, followed by roots and tubers and finally by fruits. [See FSTA (1982) 14 1A23.] RM

5

[Pot experiments on the effect of increasing amounts of sewage sludge on the heavy metal contents of some leaf vegetables.] Der Schwermetallgehalt einiger Blattgemüse in Abhängigkeit von steigenden Müll-Klärschlammgaben in Gefäßversuch. [Lecture]

Forough, M.; Venter, F.; Teicher, K.

Landwirtschaftliche Forschung, Sonderheft No. 36, 426-437 (1980) [many ref. De, en, fr] [Staatliche Fachakad., D-8910 Landsberg/Lech, Federal Republic of Germany]

Increasing amounts of sewage sludge were mixed into 3 different types of soil (sand, loam, peat) and the effects on EDTA-soluble and total heavy metals in the soils and in leaf crops (spinach, lettuce and corn salad (*Valerianella locusta*)) were investigated in pot experiments. Results, shown graphically and in tables, revealed that Zn and Cu concn. in the plants were increased with rising supply in the soil; Mn contents in the plants decreased with increasing applications of sewage sludge, while Cd, Cr and Ni contents were not affected. Despite the relatively high amounts of EDTA-soluble toxic heavy metals in sewage sludge (especially Pb and Ni), the heavy metal contents in the crops were not significantly affected. The greatest variations in Pb contents were found in spinach. [See FSTA (1982) 14 1A23.] RM

6

Lysimeter and field studies on land application of wastewater sludges.

Webber, M. D.; Soon, Y. K.; Bates, T. E.

Water Science and Technology 13 (2) 905-917 (1981) [16 ref. En] [Wastewater Tech. Cent., Environment Canada, Burlington, Ontario L7R 4A6, Canada]

Lysimeter and field studies were undertaken in Ontario to determine the effects on crop yield and quality and on groundwater quality of land application of sludges containing Al, Fe and Ca added to remove P from wastewater. Concn. of Cd, Zn, Cu, Ni, Pb and Cr were determined in crops (including wheat grain and corn) grown on soils treated with sludge and

commercial fertilizer; results are discussed and shown in histogram form. Results indicated that large increases in trace metal contents in crops occurred only where sludge applications greatly exceeded the amounts recommended. AL

7

[Concentrations of some essential and non-essential trace elements in various organs of fattening pigs.]

Untersuchungen über die Konzentration einiger essentieller und nicht-essentieller Spurenelemente in verschiedenen Organen von Mastschweinen. [Lecture] Schenkel, H.; Berschauer, F.; Gaus, G.

Landwirtschaftliche Forschung, Sonderheft No. 36, 307-315 (1980) [26 ref. De, en, fr] [Univ. Hohenheim, Postfach 106-06100, D-7000 Stuttgart 70, Federal Republic of Germany]

22 fattening pigs of different breeds were examined for Fe, Zn, Cu, Mn, Cd and Pb concn. in the liver, muscles, and kidneys (medulla and cortex) and for carry-over from the feed. Tabulated results showed the highest metal concn. in the liver (except for Cd), with mean concn. of the 6 elements ($\mu\text{g/g DM}$) 485.3, 230.4, 82.8, 11.8, 0.097, 0.244 in liver, 64.2, 104.1, 5.85, 0.407, 0.013, 0.122 in muscle, 201.5, 117.6, 38.8, 7.04, 0.856 and 0.221 in kidney (1.15 - 1.84 times higher in the cortex than in the medulla). Cd and Pb concn. did not exceed the German health guide values, and were not affected by breed. The effects of breed on other elements (Fe, Zn, Cu, Mn) require confirmation with larger numbers of animals. Feeding rations with 0.048 p.p.m. Cd and 0.41 p.p.m. Pb (DM basis) resulted in $\frac{1}{2}$ the feed concn. of Pb in liver, kidney and muscle, but 20 times the feed Cd concn. in kidney and 2 times the feed concn. in liver. [See FSTA (1982) 14 1A23.] RM

8

Effect of selenium and cadmium additions to soil on their concentrations in lettuce and wheat.

Cary, E. E.

Agronomy Journal 73 (4) 703-706 (1981) [14 ref. En] [US Plant, Soil & Nutr. Lab., USDA, SEA-AR, Ithaca, New York 14843, USA]

Se was added to prepared (i) Mardin and (ii) Lima soil at 0, 2, and 4 $\mu\text{g/g}$ as Na_2SeO_3 and Cd at 0, 2 and 8 $\mu\text{g/g}$ as CdCl_2 in a 3×3 factorial design plot. 2 crops of Black Seeded Simpson lettuce were grown on the (ii) soil, one before and one after the soil was cropped to spring wheat cv. Sheridan; only wheat was grown on (i). In all crops there was a correlation ($P < 0.01$) between the concn. of element added to the soil and concn. of that element in plant tissue. Interactions of Se \times Cd are discussed; addition of Se to a soil supporting plant growth in which high levels of Cd are found does not appear to be a practical way to reduce Cd concn. in plants. LH

9

Contamination of food: mycotoxins and metals.

[Review]

Gloag, D.

British Medical Journal 282 (6267) 879-882 (1981) [27 ref. En] [British Med. Ass., Tavistock Square, London WC1H 9JR, UK]

This review considers contamination of foods with mycotoxins (including ergot and aflatoxins), Hg and Cd, and covers foods commonly contaminated, levels of contamination, toxicological aspects, and the practical significance for human health. AJDW

10

[Cadmium intake from wild mushrooms.]

Cadmiumaufnahme mit wild wachsenden Pilzen. Lorenz, H.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 173 (1) 7-8 (1981) [8 ref. De, en] [Zentrale Erfassungs & Bewertungsstelle des Bundesgesundheitsamtes, Postfach, D-1000 Berlin 33]

A brief review is given of the significance of Cd in wild mushrooms; animal absorption studies and measurements of faecal excretion of Cd by human volunteers consuming excessive levels of wild mushrooms are discussed. Data on availability of Cd from mushrooms in human digestive tract are not available, but on the basis of a preliminary WHO report that assumes an absorption rate of 5%, the Federal German Health office (Bundesgesundheitsamt) recommends that no more than 200-250 g wild mushrooms be consumed/wk. DIH

11

[Determination of cadmium and copper in dried milk products by solvent extraction-flameless atomic absorption spectrometry.]

Suzuki, T.; Takeda, M.; Uchiyama, M.

Bulletin of the National Institute of Hygienic Sciences [Eisei Shikenjo Hokoku] 98, 102-107 (1980) [8 ref. Ja, en]

Determination of cadmium and copper was investigated by combination of sodium diethyldithiocarbamic acid (DDTC)-methylisobutylketone extraction system and a flameless atomic absorption spectrometer equipped with a carbon tube atomizer. Ashing conditions were more critical than atomizing; the sensitivity was 0.4 and 5 $\mu\text{g/kg}$ for Cd and Cu at 1% absorption. The presence of metals such as Fe, Ni and Co, which chelate with DDTC interfered with the determination. pH < 4 and > 9 affected the extraction of Cd. Recoveries of added 0.02 p.p.m. Cd and 0.5 p.p.m. Cu to a modified dried milk were 96 and 97% resp. For 10 commercial products the Cd content was < 0.01 p.p.m. and the Cu content 0.19-0.72 p.p.m. AS

12

[Seasonal variation in heavy metal content of the edible portion of short-neck clam, *Tapes japonica*.] Kumagai, H.; Saeki, K.

Bulletin of the Japanese Society of Scientific Fisheries [Nihon Suisan Gakkai-shi] 46 (7) 851-854 (1980) [17 ref. Ja, en] [Yamaguchi Prefectural Res. Inst. of Health, Aoi, Yamaguchi City 753, Japan]

In order to elucidate seasonal variation in heavy metal content of benthos [bottom flora and fauna] inhabiting the shallow waters unaffected with industrial waste disposal, total Hg, Se, Zn, As, Cu, Co, Cd, Cr, Pb, Mn and Ni were determined in the edible portion of short-neck clam obtained at Aio-cho in Yamaguchi Prefecture during 1977-1979. A seasonal variation with a max. in winter was found in levels of Hg, Co, Cd, Cr, Pb, Mn and Ni, whereas seasonal consistency was observed in the levels of Se, Zn, As and Cu. AS

13

[Contents of some metals in squids (*Loligo vulgaris* and *Illex illecebrosus*).]

Gajewska, R.; Nabrzyski, M.
Roczniki Panstwowego Zakladu Higieny 31 (2) 169-171 (1980) [8 ref. Pl, ru, en] [Zaklad Bromatologii, AM, Gdansk, Poland]

Mean values with ranges for metal contents ($\mu\text{g}/100\text{ g}$) of samples of whole squid (species no stated); 16 samples of squid with skin removed, packaged in polyethylene bags and manufactured by PPDiUR 'Odra' factory in Swinoujscie (Poland); and of squid dishes, 2 samples of 'squid tripe', 4 samples of 'squid in broth' and 4 samples of 'squid in Greek sauce' from the Polish market in polyethylene packs were resp.: Hg, 1.4 (1.1-3.5), 1.2 (1.0-2.0), 3.0 (no range), 1.0 (0-2.1), and 1.0 (0-2.1); Cd 258 (144-520), 38 (13-75), 10 (no range), 17.5 (10-25), and 9 (no range); Pb, 7.8 (2.5-15.8), 5.8 (0.7-15), 5 (no range), 5.2 (2-8.3), and 11.2 (10-12.3); Zn, 1808 (1080-2507), 1226 (900-1720), 1860 (no range), 1890 (1780-2000), and 930 (900-960); and Cu 695 (380-1346), 125 (65-175), 143 (no range), 210 (185-235), and 124 (100-148). SKK

189

14

[Content of metals in meat additives.]

Polic, M.; Djulic, I.; Bastic, L.
Tehnologija Mesa 21 (9) 253-255 (1980) [11 ref. Sh, en] [Jugoslovenski Inst. za Tehnologiju Mesa, Belgrade, Yugoslavia]

Studies were conducted to determine concn. of essential metallic elements (Fe, Ca, Mg, Na, K, Mn, Cu, Co, Zn) and toxic metals (Pb, As, Sb, Hg, and Cd) in curing brine, various protein preparations, spices, monosodium glutamate, smoke concentrates and glucono- δ -lactone. Tables of data are given for concn. of metals in these additives. STI

15

Concentration of cadmium, copper, selenium, zinc and lead in tissues of New Zealand cattle, pigs, and sheep.

Solly, S. R. B.; Revfeim, K. J. A.; Finch, G. D.
New Zealand Journal of Science 24 (1) 81-87 (1981) [En] [Wallaceville Anim. Res. Cent., Min. of Agric. & Fisheries, Upper Hutt, New Zealand]

Cd, Cu, Zn and Pb were determined by AAS in kidney and liver samples of cows, sheep and pigs; Se was determined by the fluorometric method of Watkinson [Analytical Chemistry (1966) 38, 92-97]. Current New Zealand tolerance levels for these 5 elements are 1, 30, 40, 2 and 2 mg/kg, resp. Results indicate that for Cu and Zn levels in liver these tolerances are not realistic (Cu level in cattle liver was 78 mg/kg, in sheep 155 and in pig 13; Zn levels were correspondingly 61, 54 and 103 mg/kg). Other levels generally complied with tolerance values. LH

16

[Determination of Pb and Cd distribution in bovine liver, in relation to appropriate sampling technique.] Beurteilung der Blei- und Cadmiumverteilung in der Rinderleber unter dem Gesichtspunkt einer geeigneten Probenentnahme.

Holm, J.
Fleischwirtschaft 61 (7) 1053-1055 (1981) [7 ref. De, en] [Staatliches Veterinäruntersuchungsamt Braunschweig, Dresdenstrasse 6, D-3300 Braunschweig, Federal Republic of Germany]

Livers from 1 animal from an area with low pollution, 1 animal from an area with normal pollution and 5 animals from polluted areas were used. Pb and Cd concn. (determined by AAS) in samples from 7 defined sites in each liver were compared with concn. in mixed liver homogenates, prepared from each liver. Tables of results are given. Results for the individual samples and the homogenates agreed well for the animal from an area with low pollution. Livers from animals from polluted areas show a non-uniform distribution of Pb. Optimization of sampling of livers for heavy metal analysis is discussed; it is suggested that the *lobus caudatus* should be used; this location can be specified clearly in sampling instructions, and gives results agreeing well with the mean values of other sites, and of composite samples. AJDW

17

[Flameless atomic absorption determination of lead and cadmium in poultry products.]

Martynyuk, T. G.; Sevast'yanova, N. I.; Nikolaeva, V. A.; Mukhtarov, E. I.

Voprosy Pitaniya No. 2, 16-19 (1981) [4 ref. Ru] [Nauchno-proizvodstvennoe Ob"edinenie Ptitsepererabatyvayushchei i Kleezhelatinovoi Promyshlennosti 'Kompleks', Moscow, USSR]

Variations in the AAS technique (e.g. use of HNO_3 , HCl or aqua regia for ashing) were assessed in determining Cd and Pb content in chicken muscle and liver tissues and in hens' egg samples; possible sources of error (e.g. effect of background absorption) are also discussed. A comparison was also made between detn. by a calibration method and a standard reference method (good agreement was obtained between the 2 methods). Recoveries from samples spiked with 0.25-1 mg Pb/kg or 0.050-0.200 mg Cd/kg, and method reproducibility are also tabulated (the latter was lower than levels reported elsewhere in the literature). RAW

18

[Recent data on the biological effects of cadmium.]
[Review]

Bethmont, J. L.

Cahiers de Nutrition et de Dietetique 16 (1) 59-67 (1981) [75 ref. Fr, en]

This review contains a list of the mean Cd values found in a range of foods (cereals, vegetables, fruits, meat, eggs, fish, milk, fats and beverages). Metabolic and toxicity aspects are also covered. HBr

19

[Exposure of consumers to Cd. A critical review.] Die Belastung des Verbrauchers durch Cadmium - eine kritische Übersicht. [Review]

Diehl, J. F.

Berichte der Bundesforschungsanstalt für Ernährung No. 3, 85pp. (1981) [many ref. De, en] [Inst. für Biochem., Bundesforschungsanstalt für Ernährung, Karlsruhe, Federal Republic of Germany]

Aspects considered in this review on Cd in the diet and consequent health hazards include: adverse comment in the media; the FAO/WHO max. daily intake value (1 µg Cd/kg body wt.); Cd intake from food by consumers in various countries; trends in Cd pollution of foods and the environment; absorption and excretion of dietary Cd; Cd accumulation in the body; critical Cd concn. in the kidneys; dose/effect relationships; possible extreme cases of Cd intake; and Cd in relation to high blood pressure and cancer. It is concluded that Cd concn. in foods in the Federal Republic of Germany are similar to those in other countries, and that Cd intakes are below the FAO/WHO recommended level. AJDW

20

[Inverse-polarographic determination of trace elements (Cd, Pb, Cu, Sn) in evaporated milk.]

Inverspolarographische Bestimmung von Spurenelementen (Cd, Pb, Cu, Sn) in Kondensmilch. Mrowetz, G.

Milchwissenschaft 36 (8) 479-481 (1981) [4 ref. De, en] [Inst. für Chem. & Physik, Bundesanstalt für Milchforschung, Kiel, Federal Republic of Germany]

The method consists of ashing 1 g evaporated milk in a quartz crucible for 3 h at 500°C. The ash is dissolved in 0.2 ml concn. H₂SO₄, diluted with 10 ml water and used for the polarographic detn. of Cd, Pb and Cu. The solution is mixed with 5 ml concn. HCl for the detn. of Sn. Detection limits for Cd, Pb, Cu and Sn were resp. 0.005, 0.017, 0.012 and 2.6 mg/kg. Examination of 12 different samples of evaporated milk showed that the Cd content was below the detection limit, Pb contents ranged from 0.13 to 1.60 mg/kg, Cu from 0.20 to 0.58 mg/kg and Sn from <2.6 to 115 mg/kg. Samples from cans with a protective varnish had the lowest contents of Pb and Sn. [See also FSTA (1981) 13 1P16.] AS

21

A survey of heavy metals in the surf clam, *Spisula solidissima*, and the ocean quahog, *Arctica islandica*, of the mid-Atlantic coast of the United States.

Wenzloff, D. R.; Greig, R. A.; Merrill, A. S.; Ropes, J. W. *Fishery Bulletin, National Oceanic and Atmospheric Administration* 77 (1) 280-285 (1979) [16 ref. En] [Northeast Fisheries Cent. Milford Lab., Nat. Marine Fisheries Service, NOAA, Milford, Connecticut 06460, USA]

Heavy metals (Ag, As, Cd, Cu, Zn, Cr, Hg, Ni, and Pb) were determined in (i) surf clams and (ii) ocean quahogs from 151 locations. Concn. of Cd, Cu, Pb, and Zn in both spp. were well below recommended max. concn., but the limit of 1.14 p.p.m. As was exceeded at all but a few sampling stations, overall mean being 2.1 p.p.m. for (i) and 3.0 p.p.m. for (ii). Hg concn. were well below FDA action limits. Average concn. of Ag, As, Cd, Cu and Zn were higher in (ii) than in (i) for the entire survey. JRR

22

[Various Cd compounds in feed for laying hens and broilers.] Einsatz verschiedener Cadmiumverbindungen im Broiler- und Legehennenfutter.

Nezel, K.; Matthes, S.; Vogt, H.

Archiv für Geflügelkunde 45 (3) 120-125 (1981) [6 ref. De, en, fr, ru] [Inst. für Kleintierzucht, Forschungsanstalt für Landw., D-3100 Celle, Federal Republic of Germany]

Groups of Lohmann broiler chicks and LSL (Leghorn type) laying hens were fed diets with 0, 20 or 40 p.p.m. Cd as cadmium acetate, cadmium-cysteine or CdS. The broilers received the experimental diets for ≤49 days, the laying hens for 336 days. Data are given for growth of the birds, and for Cd concn. in tissues, and elastic deformation characteristics of the egg shell. The results show that both cadmium acetate and cadmium-cysteine caused Cd accumulation in tissues (max. 300 p.p.m. in kidneys of laying hens fed cadmium acetate). The Cd concn. in tissues increased with increasing Cd concn. in the diet, and duration of feeding of the Cd-containing feeds. Little Cd accumulated in muscle tissue on any diet. Cadmium acetate impaired shell stability of the eggs. CdS, which is of low solubility, did not affect elastic deformation of the shell, and caused only slight accumulation of Cd in the tissues. AJDW

23

Sample preparation methods for the analysis of metals in foods by atomic absorption spectrometry - a literature review. [Review]

Blake, C. J.

Scientific and Technical Surveys, Leatherhead Food RA No. 122, 53pp. (1980) [many ref. En, fr, de] Price Members £5.50 Non-members £10.00 [Leatherhead Food RA, Randalls Road, Leatherhead, Surrey, UK]

This survey reviews methods which have been published in the literature for the preparation and treatment of samples of food prior to the determination of trace metals by AAS. The survey is divided into 2 parts: Destruction of organic matter (pp. 4-14); and Preparation methods for specific foodstuffs (pp. 15-34).

The first part of the survey covers: wet oxidation, rapid acid extraction methods, automatic digestion systems, digestion bombs, microwave treatments, dry ashing, O₂-flask combustion, low temp. dry ashing, separation and concn. Part I ends with a treatment of the practical aspects of making AAS measurements, covering flame and flameless AAS. Part II outlines methods of sample preparation and treatment for the following classes of foods: beers; canned foods; cocoa powder; eggs; fish and seafoods; flavouring materials; food colours; fruit juices and soft drinks; plant materials; instant coffee; meat and meat products; milk and dairy products; oils and fats; spices; sugars; tea; and wines and spirits. VJG

24

Lead, cadmium, and mercury contents of fungi in the Helsinki area and in unpolluted control areas.

Kuusi, T.; Laaksovirta, K.; Liukkonen-Lilja, H.; Lodenius, M.; Piepponen, S.

Zeitschrift für Lebensmittel-Untersuchung und -Forschung 173 (4) 261-267 (1981) [28 ref. En, de] [Tech. Res. Cent. of Finland, SF-02150 Espoo 15, Finland]

Wild-growing fungi, mainly edible types, were collected from (i) Helsinki urban area (242 samples) or (ii) rural locations in Finland (84 samples). More than 40 spp. were represented, both saprophytes and mycorrhizal symbionts being included. Tabulated data show number of samples of each sp. collected, and means and ranges of Pb, Cd, and Hg contents, as determined by AAS. *Agaricus* spp. and the *Gasteromycetes* (with saprophytes) had high metal contents in both (i) and (ii), highest levels observed being 78 mg Pb/kg DM, 101 mg Cd/kg DM and 95 mg Hg/kg DM. Mean contents for each sp. were in the following ranges (mg/kg DM) for saprophytes and mycorrhizal fungi, resp.: Pb (i) 1.7-16.8, (ii) <0.5-13.0; (i) 0.5-8.9, (ii) <0.5-3.6; Cd (i) 0.5-11.9, (ii) 0.2-16.8; (i) <0.2-17.3, (ii) 0.3-4.1; Hg (i) 0.11-14.1, (ii) 0.07-4.2; (i) 0.02-4.14, (ii) 0.02-0.73. In general, saprophytes had higher metal contents than did mycorrhizal fungi, especially in (i), and (i) samples had higher metal contents than did those from (ii); in the case of saprophytes this was always very significant if *Agaricus* spp. were excluded, as these tended always to accumulate high metals contents. It is concluded that, as the bulk of edible fungi collected in Finland are mycorrhizal symbionts from rural sites, there is little danger to human health from heavy metals, although moderation in use of *Agaricus* spp. is recommended. DIH

25

[Heavy metals in long-life bakery products. Determination of Pb and Cd by flameless AAS.]

Untersuchungen über den Schwermetallgehalt von Dauerbackwaren. Bestimmung von Blei und Cadmium mittels flammenloser AAS.

Knezevic, G.

Zucker- und Süßwarenwirtschaft 34 (7/8) 242, 244 (1981) [8 ref. En] [Fraunhofer-Inst. für Lebensmitteltech. & Verpackung, Schragenhofstrasse 35, 8000 Munich 50, Federal Republic of Germany]

11 samples of various long-life bakery products (biscuits, rusks, wafers, etc.) were analysed for Pb and Cd by flameless AAS. Tables of results are given. Pb concn. ranged from 0.92 to 0.14 mg/kg; Cd concn. ranged from 0.01 to 0.06 mg/kg. These values were well below the Bundesgesundheitsamt limiting values for Pb and Cd in cereals. AJDW

26

[Distribution of trace elements in milk components.]

Bernatonis, I.; Ramonaitite, D.

Trudy, Litovskii Filial Vsesoyuznogo Nauchno-issledovatel'skogo Instituta Maslodol'noi i Syrodel'noi Promyshlennosti 12, 46-51, 152 (1978) [10 ref. Ru, li, en] [Litovskii Filial VNIIMSP, Kaunas, USSR]

Bulk milk of cows in the middle of lactation was separated; the skim milk was fractionated into casein, whey and casein wash water, the whey was heated to 100°C and divided into whey proteins and filtrate; the cream from separation (49% fat) was diluted to 35% fat with water, fractionated into buttermilk, butter plasma and milk fat; the butter plasma was centrifuged, 2 wash waters and washed cream being obtained, the last was in turn fractionated into buttermilk, butter plasma and milk fat. 16 fractions in all were obtained from milk, and Cu, Zn, Co, Ni and Cd were determined in each by polarographic methods. Milk to which the elements were added as sulphates were fractionated and analysed 12 h later. Contents of the trace elements in each fraction are tabulated as well as their % distribution among some milk components. For the natural milk, the distribution in casein, whey proteins, milk fat, milk fat globule membrane and solution of non-protein compounds was resp. (%): Cu, 29.0, 14.4, 5.6, 12.5 and 27.7; Zn, 27.5, 3.5, 0.2, 3.3 and 57.7; Ni, 11.0, 10.0, 0.9, 4.5 and 59.9; and Cd, 53.8, 2.8, 0, 0 and 35.9. Some of the differences from 100% are accounted for by fractionation losses. Contents of Cu, Zn, Ni and Cd in milk (4% fat) were resp. 6.88, 343, 1.46 and 1.35 µg%. SKK

27

Residues of meats and additives - studies and perspectives. (In 'Meat in nutrition and health' [see FSTA (1982) 14 4S569]) [Lecture]

Ferrando, R.

pp. 151-176 (1981) [88 ref. En] [Lab. of Nutr. & Feeding Nat. Vet. Coll., Alfort, France]

This review deals with the sources and hygienic risk of residues in meat, under headings of: residues originating from natural contaminants owing to the infestation of the animals' food by microorganisms productive of mycotoxins; residues originating from pesticides used in agriculture and reaching meats by way of the alimentary chain - the case of heavy metals is also examined; residues originating from additives used in animal feed and medication used in veterinary therapy; substances used in the preparation of meat products, especially pork butchery; perspectives raised by the question of residues on material, sanitary and legislative levels, involving the necessity for a total, objective study. LH

28

Ceramic ware in contact with food - release of lead and cadmium - I. Method of test.

International Organization for Standardization
International Standard ISO 6486/1:1981, 4pp. (1981)
[5 ref. En]

A test method is specified to determine the release of Pb and Cd by ceramic ware which may be used in contact with food, e.g. ceramic ware made of china, porcelain and earthenware, whether glazed or not, but excluding glass, glass ceramic and porcelain enamel articles. It applies to ceramic ware which may be used for the preparation, serving and storage of food and beverages, excluding those used in food manufacturing industries or those in which food is sold. The method involves extraction of Pb and Cd by an acetic acid solution from the surfaces which would normally come in contact with food, and detn. by AAS of the amounts of Pb and Cd extracted. [See also following abstr.] AL

29

Ceramic ware in contact with food - release of lead and cadmium - II. Permissible limits.

International Organization for Standardization
International Standard ISO 6486/2:1981, 2pp. (1981)
[5 ref. En]

Permissible max. limits for Pb and Cd release from 3 types of ceramic ware are, resp.: flatware 1.7 and 0.17 mg/dm²; small hollow-ware 5.0 and 0.50 mg/l; and large hollow-ware 2.5 and 0.25 mg/l. [See also preceding abstr.] AL

30

[Quantitative determination of As, Pb, Cd, Hg and Se in foods by flameless AAS.] Quantitative Bestimmung von Arsen, Blei, Cadmium, Quecksilber und Selen in Lebensmitteln mit Hilfe flammenloser Atom-Absorptions-Spektrophotometrie.
Müller, H.; Siepe, V.

Deutsche Lebensmittel-Rundschau 77 (11) 392-400 (1981) [6 ref. De, en, fr] [Consumer Res. & Development, Knorrstrasse 1, D-7100 Heilbronn, Neckar, Federal Republic of Germany]

A device developed for wet-ashing of food samples for subsequent analysis by AAS is described in detail; results of recovery studies on various foods are given. Ranges of values for % recoveries were: As 84-98; Cd 92-110; Hg 69-82; Pb 73-94; and Se 85-107.

A procedure for AAS detn. of these elements after extraction as diethylammonium diethyldithiocarbamate derivatives is described in detail; specific AAS conditions for As, Pb, Cd, Hg and Se are given. Detection limits were (parts/billion): As 3; Pb 4; Cd 2; Hg 2-3; and Se 15. This method was used for detn. of As, Cd, Hg, Pb and Se in a wide range of foods; a table of results is given. AJDW

31

[Use of complex units for the analytical control of foods.]

Manolov, K.; Machev, A.; Stamatova, V.; Kozhukharova-Statelova, A.

Nauchni Trudove, Vissht Institut po Khranitelna i Vkusova Promyshlennost 25 (1) 289-292 (1978) [5 ref. Bg]

Using tomato juice and seasoned aubergines as examples, a technique for spectrophotometric detn. of K and Cd in foods is described. Zn interfered with the detn. of Cd only at Zn:Cd ratios of > 1000:1. HBr

32

[Pb and Cd contamination of foods. I. Cereal products.]

Bolasco, A.; Memoli, A.; Alimonti, A.; Lucarini, C.
Farmaco, Edizione Pratica 36 (4) 223-227 (1981)
[12 ref. It, en] [Univ. degli Studi di Roma, Rome, Italy]

Commercial samples of flour, bread, pasta, biscuits, etc. were analysed for Pb and Cd contamination. Tabulated results show a steady rise in contamination from 1974 onwards. Pb concn. ranged from 0.02 to 1.0 p.p.m., Cd from 0.02-0.37 between 1974 and 1977 (published data), while recent results in pasta were 0-2.51 p.p.m. Pb (mean 1.00) 0-0.73 p.p.m. Cd (mean 0.22), in bread 0-2.44 (mean 1.37) and 0.032 (mean 0.16), in other products 0.24-1.97 (mean 1.20) and 0.08-0.37 (mean 0.23) resp. RM

33

Heavy metals in *Mercenaria mercenaria* and sediments from the New Bedford Harbor Region of Buzzard's Bay, Massachusetts.

Genest, P. E.; Hatch, W. I.

Bulletin of Environmental Contamination and Toxicology 26 (1) 124-130 (1981) [31 ref. En] [Dep. of Biol., Southeastern Massachusetts Univ., North Dartmouth, Massachusetts, USA]

Mercenaria mercenaria and sediments collected from several sites in the New Bedford region (the first weekend of every month from April 1978 to March 1979) were analysed for Cd, Cu, Fe, Pb, and Zn. Results showed that Cd and Cu showed no differences according to site. Tissue Fe concn. varied slightly between sites while Pb content was significantly site dependent. Zn values were erratic, site related and had significant interaction between season and site. *M. mercenaria* tissue levels of the 5 metals studied appear to be within safe limits in terms of public health even though Cu approached the permissible levels established for Australia. VJG

34

Distribution and significance of copper, lead, zinc and cadmium in the Corio Bay ecosystem.

Smith, J. D.; Butler, E. C. V.; Grant, B. R.; Little, G. W.; Millis, N.; Milne, P. J.

Australian Journal of Marine and Freshwater Research 32 (2) 151-164 (1981) [32 ref. En] [Marine Chem. Lab., School of Chem., Univ. of Melbourne, Parkville, Victoria 3052, Australia]

Levels of Cu, Pb, Zn and Cd were measured in sediments, waters and mussels (*Mytilus edulis*) from Corio Bay (Victoria), a bay known to have received a major input of Cd. The respective concn. of Cu, Pb, Zn and Cd in mussels were 4.8-21, 1.2-9.7, 105-410 and 9.8-53 µg/g on a dry wt. basis. AS

35

Elimination of laboratory-acquired cadmium by the oyster *Crassostrea virginica* in the natural environment.

Mowdy, D. E.

Bulletin of Environmental Contamination and Toxicology 26 (3) 345-351 (1981) [12 ref. En] [FDA, Gulf Coast Technical Service Unit, Dauphin Island, Alabama 36528, USA]

Shellfish grown in estuarine areas with bacterial pollution can be used as commercial food.

study the feasibility of relaying Cd-contaminated oysters, oysters containing laboratory-incurred Cd were studied. The fortified control samples contained 1 p.p.m. added Cd, and each fortified experimental sample contained 10 p.p.m. added Cd. The oysters were held in flumes with flowing estuarine water for 2 days after dosing was discontinued. The experimental sample taken on the day of transfer to the bay contained 5.9 p.p.m. Cd, which was 57% of the amount of Cd found in the same group of oysters 2 days earlier. During the next 42 days, the Cd concn. in the experimental oysters decreased to 3.0 p.p.m., which represented a 71% loss of Cd from the day dosing was discontinued. A slower rate of elimination occurred during the remainder of the study. Ranges of water temp. and salinity were also determined during Cd elimination. Results showed that laboratory-dosed oysters eliminated Cd in the natural estuarine environment and suggested that the rate of elimination is affected by changing water temp. and salinity. The rapid elimination which occurred before and during the first 42 days in the bay suggested the presence of free or unbound Cd. VJG

36

[Cadmium and certain other metals in liver and kidney of elk. Basis for dietary recommendations.]

Mattsson, P.; Albanus, L.; Frank, A.

Var Föda 33 (8/9) 335-345 (1981) [11 ref. Sv, en]

[Livsmedelslab., Statens Livsmedelsverk, 751 26 Uppsala, Sweden]

Cd, Pb, Zn, Cu and Mn were determined in liver and kidneys of elk (*Alces alces*) of various ages, and from various parts of Sweden. Comparative data are given for domestic cattle. Cd concn. in liver and kidney increased markedly with age, and were appreciably higher in elk tissues (up to 2.4 mg/kg wet wt. in liver, up to 13 mg/kg wet wt. in kidneys) than in corresponding tissues of domestic cattle. Considerable differences were found in Cd contents of tissue samples of elk from different parts of Sweden. Concn. of the other metals studied did not differ greatly between elk and domestic cattle tissues. On the basis of the results, it is

recommended that adult elk kidneys should not be eaten; that liver from adult moose and kidney from moose calves should be eaten not more than once or twice a month, and that liver from moose calves may be eaten once or twice/wk. Consumption of liver and kidneys from roe deer and hares is also briefly considered. AJDW

37

The cadmium content of muscle, liver and kidney from Finnish horse and reindeer.

Salmi, A.; Hirn, J.

Fleischwirtschaft 61 (8) 1175-1176 & 1199-1201 (1981) [9 ref. En & De] [State Vet. Med. Inst., POB 368, SF-00101, Helsinki, Finland]

The Cd content of muscle, liver and kidney from 142 Finnish horses was determined. The analyses were carried out by dry-ashing the biological material and measuring the Cd by flameless AAS. The mean Cd concn. in horse muscle was 0.17 mg/kg, in liver 2.99

mg/kg and in kidney 28.70 mg/kg. The tolerable weekly intake of 0.4-0.5 mg Cd recommended by FAO/WHO is contained in 145 g of horse liver or in 16 g of horse kidney. The muscle and organs of 50 Finnish reindeer (*Rangifer tarandus*) were also analysed and the corresponding Cd contents were 0.01 mg/kg, 0.19 mg/kg and 0.88 mg/kg resp. AS

38

Metal uptake by crops grown over entrenched sewage sludge.

Sikora, L. J.; Chaney, R. L.; Frankos, N. H.; Murray, C. M.

Journal of Agricultural and Food Chemistry 28 (6) 1281-1285 (1980) [22 ref. En] [Agric. Res., USDA, Beltsville, Maryland 20705, USA]

After outlining the procedures involved in entrenchment of sewage sludge and briefly reviewing previous studies of the properties of entrenched sludge, studies are reported which examined the effect of such sludges on the Zn, Cu and Cd contents of grain and leaf crops. 3 crops (oats, wheat, Swiss chard) were grown in 1977-1978 on plots established in 1972 and containing either entrenched digested sludge or entrenched limed raw sludge; both sludges were subjected to detailed analysis before and after entrenchment and found to have relatively low levels of the 3 heavy metals. In order to determine the effect of elevated surface soil pH on metal uptake by the crops, some plots were limed. Control plots (either limed or unlimed) contained no entrenched sewage sludge. Full details are included of plot entrenchment, soil sampling, liming and fertilization, planting, harvesting, and preparation of plants for metal analysis. Plant parts analysed included whole chard, oat grain and wheat grain. Results, which are detailed in tables, were subjected to statistical analysis. They indicated that metal uptake by the crops reflected metal content of sludge and pH of the sludge and subsoil more than the pH of the surface soil. Chard accumulated higher metal levels than either wheat or oats which had similar metal accumulations. Crops grown on plots containing entrenched limed raw sludge had metal levels equal to or less than levels in crops grown on limed control plots. Although liming the surface soil reduced metal uptake from digested sludge plots, metal uptake was still significantly greater than that of crops grown on limed raw sludge or control plots. On the basis of these results, it is concluded that land containing entrenched limed sludges may be used for growing crops provided the sludge is relatively low in heavy metals. JA

39

Metal contamination of food. [Book]

Reilly, C.

xvi + 235pp. ISBN 0-85334-905-3 (1980) [many ref. En] Barking, Essex, UK; Applied Science Publishers Ltd. Price £17.00 [Queensland Inst. of Tech., Brisbane, Australia]

This book provides a discussion of the part played by metals in human nutrition and health, and their content in foods. Chapters are: A peck of dirt (pp. 3-14, 12 ref.); How metals get into food (pp. 15-45, 63 ref.); Quality

control (pp. 46–63, 19 ref.); Food quality – analysis of food (pp. 64–82, 23 ref.); Lead (pp. 85–104, 52 ref.); Mercury and cadmium (pp. 105–122, 48 ref.); The toxic metalloids: arsenic, antimony and selenium (pp. 123–137, 63 ref.); The packaging metals: aluminium and tin (pp. 138–147, 30 ref.); Transition metals (pp. 148–183, 91 ref.); Other transition metals (pp. 184–189, 15 ref.); Zinc – the unassuming nutrient (pp. 190–196, 21 ref.); Beryllium, strontium, barium and the other metals – summing up (pp. 197–209, 43 ref.). A 9-pp. subject index is included. LH

40

[Contents of heavy metals in foods produced in Hokkaido. IV. Contents of heavy metals [As, Pb, Cd, Zn, Mn, Hg] in fishes and shellfishes.] Yamamoto, I.; Osanaga, H.; Sato, Y.; Sato, C. *Report of the Hokkaido Institute of Public Health [Hokkaidoritsu Eisei Kenkyusho Ho]* No. 30, 31–37 (1980) [14 ref. Ja]

In Sept. 1978 and 1979 162 samples of 43 fish spp. were taken from fish markets in Hokkaido. High levels of As were found in chub, dace, 'kurogare', Pacific cod and slime flounder (*Microstomus achne*), with mean values 40.60, 28.59, 8.43, 8.38 and 7.23 p.p.m. resp. Other fish contained As at 0.24–3.67 p.p.m. Pb was only found at low levels, 96.9% contained <0.04 p.p.m.; the highest Pb content was in 1 sample of cuttlefish 0.17 p.p.m. Scallops, squid and chub contained on average 0.238, 0.205 and 0.049 p.p.m., more than flat fish and 'soi' fish; 0.76 p.p.m. was found in 1 sample of squid. Most samples contained <1 p.p.m. Ca but chub, octopus and squid averaged 3.11–10.83 p.p.m. Levels of Zn ranged from 5–20 times those of Cu, Zn content of 'chika', scallop and squid ranged between 10 and 22 p.p.m.; single samples of octopus and cod roe contained 32.4 and 38.8 p.p.m. resp. Highest levels of Mn were in scallops, 1.06–1.20 p.p.m.; 'sunagare', scallops, sandfish (*Actoscopus japonicus*) and 'hakki' averaged 0.26–0.51 p.p.m. No fish contained more than the provisional legal limit of Hg (0.4 p.p.m.); the highest level was 0.309 in 1 sample of rock trout (*Hexagrammos otakii*). Highest average levels were in horse mackerel, halibut and rock trout, 0.241, 0.157 and 0.143 p.p.m. In rocktrout, bullhead (*Cottus pollux*), flat fish, mackerel and 'soi' fish there was a positive relationship between body wt. and Hg content. In flat fish there were positive relationships between Hg and As and between As and Zn contents. [See FSTA (1981) 13 10C346 for Part III.] CIH

41

Polychlorinated biphenyl, pesticide, and heavy metal residues in swine foraging on sewage sludge amended soils.

Hansen, L. G.; Washko, P. W.; Tuinstra, L. G. M. T.; Dorn, S. B.; Hinesly, T. D. *Journal of Agricultural and Food Chemistry* 29 (5) 1012–1017 (1981) [36 ref. En] [Dep. of Vet. Biosci., Univ. of Illinois, 1101 W. Paebody, Urbana, Illinois 61801, USA]

Berkshire sows were overwintered (2 seasons) on corn plots that over 9 yr had received cumulative totals of 0, 126, 252 or 504 t DM sewage sludge/ha. Composition of soils is described. Contents of Cd, Cu, Fe, Pb, Mn, Ni and Zn in sow tissues are tabulated; of these only Cd was increased by the sludge treatment, and only in kidney, liver and spleen, reaching max. levels in the 1st 2 tissues of 4.71 and 0.83 mg/kg fresh wt., vs 0.35 and 0.03 in controls, resp. Sludge treatment induced traces of Cd binding protein in livers and kidneys. Residues of p,p'-DDE accumulated in fatty tissues in a dose-dependent manner, reaching 101 µg/kg fresh wt. in back fat at the highest sludge application level. Sludge treatment did not lead to accumulation of lindane, heptachlor epoxide or dieldrin. Polychlorinated biphenyls (PCB) accumulated in a dose-dependent manner. Results showed that estimation of PCB content as specific Aroclors by monitoring selected GLC peaks gives misleading results; PCB components were identified by cochromatography with 31 standards; 19 were absent from sow backfat, and >50% of backfat PCB content was accounted for by 3 individual chlorobiphenyls (2,3,4,2',4',5'; 2,4,5,2',4',5'; and 2,3,4,5,2',4',5'). Environmental PCB contamination cannot be related to composition of commercial mixtures and it is recommended that, rather than estimate total PCB concn. by monitoring selected peaks, that perchlorination procedures be used to determine total chlorobiphenyls, or ideally, that PCB composition in samples be precisely characterized from a complete set of standards. Mean total PCB content of backfat at the highest treatment level (sum of 12 individually quantitated PCB) was 300–400 µg/kg fat, vs. <35 µg/kg for controls. DIH

42

Renal cadmium and zinc concentrations in horses in Norway.

Bjorland, J.; Norheim, G.

Nordisk Veterinaermedicin 33 (12) 530–534 (1981) [10 ref. En, no] [Oslo Off. Kjottkontroll, Postboks 36 Refstad, Oslo 5, Norway]

50 samples of horse kidney from the south-east of Norway were analysed for Cd and Zn by AAS. Results are presented graphically. Max. recorded Cd concn. was 119 µg/g wet wt. basis. Kidney Cd content tended to increase with horse age up to 10 yr, and to decrease somewhat at ages ≥ 12 yr. Mean Cd and Zn concn. were 48 ± 23 and 42 ± 8 µg/g wet wt. resp.; Cd and Zn concn. were linearly related. It is concluded that the high Cd content of horse kidneys renders them unsuitable for use as food. AJDW

43

[Heavy metals in foods.] Schwermetalle in Lebensmitteln.

Anon.

Seifen-Öle-Fette-Wachse 107 (17) 524 (1981) [De]

44

[Contents of cadmium in brown rice sent to Tokyo.]
Ito, K.; Harada, H.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 31 (1) 142-148 (1980)
[2 ref. Ja] [Metropolitan Res. Lab. of Public Health, Hyakunincho 3 chome, Shinjuku-ku, Tokyo, Japan]

In 1196 individual samples of brown rice taken from areas supplying Tokyo during 1973-1980, Cd ranged from not detected (n.d.) to 3.04 p.p.m. with mean 0.062 and s.d. 0.028 p.p.m.; in 39 samples Cd exceeded the standard of 0.4 p.p.m. In 304 bulked samples from the same areas Cd was n.d. - 0.56 p.p.m. with mean 0.087 ± 0.023 p.p.m.; Cd content exceeded the standard in 5 samples. Differences in Cd content between officially and privately marketed rice were not significant. Rice from Hokkaido and Aomori prefecture contained less Cd than rice from further south. CIH

45

Seasonal levels of chlorinated hydrocarbons and heavy metals in fish and brown shrimps from the Medway Estuary, Kent.

Broek, W. L. F. van den

Environmental Pollution 19 (1) 21-38 (1979) [33 ref. En] [Dep. of Biological Sci., City of London Polytechnic, Old Castle Street, London E1, UK]

The river Medway (UK) is surrounded by industrial areas but is also bordered by cultivated land (particularly orchards); sewage effluents are treated but insecticides and heavy metals may remain. Detn. were made of the contents of a number of pesticides and heavy metals (Hg, Cd, Cu, Pb, Zn) in several spp. of fish (e.g. eel, flounder, whiting, plaice) and brown shrimps, collected from cooling water of a power station intake and covering seasonal variations. Shrimps were analysed whole and fish were divided into lateral musculature, liver, gut wall and gonad. Homogenized samples were dried with anhydrous Na_2SO_4 , extracted with n-hexane and fractionated by column techniques. For detn. of metals samples were digested with 1:1 HNO_3 : H_2SO_4 for Hg and with HNO_3 for other metals, followed by AAS (details given). Quantifiable results were obtained for dieldrin, DDE, DDT, TDE and polychlorinated hydrocarbons (PCH), but values were low with only PCH some times approaching max. limits. Only minute traces were found of aldrin, endrin and α - and β -BHC. Results (showing max.-min. ranges, monthly variations, spp. differences, size and lipid content) are tabulated for DDT, dieldrin and PCH. Pesticide contents of estuary water were very low, with no seasonal variation attributable to spraying activity; there was some evidence of food chain concentration and levels were correlated with the lipid content of tissues. Metal concn. were negligible (background only) and were no higher than in the open sea. ELC

46

[Recommendations for consumption of liver and kidneys.]

Sweden, Statens Livsmedelsverks

Statens Livsmedelsverks Meddelanden M 8-81, 2pp. (1981) [Sv]

Possible hazards from high Pb and Cd concn. in liver and kidneys of domestic and game animals are discussed. Recommendations are given for max. weekly/monthly frequency of consumption of liver from pigs, calves, lambs, adult cattle and sheep, hares, and young or old deer. Poultry liver, which does not generally have high Cd or Pb concn., is not considered; nor is liver pate, of which liver forms only a part. AJDW

47

Determination of heavy metals in sea water and in marine organisms by flameless atomic absorption spectrophotometry. XIV. Comments on the usefulness of organohalides as solvents for the extraction of heavy metal (Cd) complexes.

Sperling, K.-R.

Zeitschrift für Analytische Chemie 310 (3/4) 254-256 (1982) [11 ref. En] [Biol. Anstalt Helgoland, Wüstland 2, D-2000 Hamburg 55, Federal Republic of Germany]

Conditions for flameless AAS detn. of trace metals, e.g. Cd, were standardized, allowing detn. in extremely small samples (ml to μl). [See FSTA (1981) 13 12A789 for part XIII.] RM

48

Metal accumulation and crop yield for a variety of edible crops grown in diverse soil media amended with sewage sludge.

Garcia, W. J.; Blessin, C. W.; Inglett, G. E.; Kwolek, W. F.; Carlisle, J. N.; Hughes, L. N.; Meister, J. F.
Environmental Science & Technology 15 (7) 793-804 (1981) [19 ref. En] [N. Reg. Res. Cent., USDA, Peoria, Illinois 61604, USA]

15 crops were grown in randomized field plots on various soils, and the possible benefits and risks of using sewage sludge on these soils for crop production were assessed. Protein, moisture and ash contents were analysed in edible parts of cabbages, beans, onions, beetroots, tomatoes and radishes; metal accumulation (Pb, Hg, Cd, Zn) was evaluated in edible parts of lettuce, tomatoes, onions, radishes and wheat. Results are tabulated. Nutritional quality was not affected by the different soil treatments. Lettuce accumulated high metal levels, and reflected soil metal concn., whereas tomatoes had low metal concn. regardless of soil levels, and would thus be a suitable crop for sludge-amended soils. Sludge was used to more advantage as regards yield on disturbed soils (e.g. coal mine gob). LH

49

Determination of heavy metals in a menhaden oil after refining and hydrogenation using several analytical methods.

Elson, C. M.; Bem, E. M.; Ackman, R. G.

Journal of the American Oil Chemists' Society 58 (12) 1024-1026 (1981) [15 ref. En] [Dep. of Chem., Saint Mary's Univ., Halifax, Nova Scotia, Canada B3H 3C3.]

A series of menhaden oils (crude, degummed, degummed + gums, refined, refined and bleached, hydrogenated and filtered, hydrogenated, filtered and bleached, and hydrogenated, filtered, bleached and deodorized), collected at various stages of processing were analysed for Zn, Cd, Pb, Cu and As by wet digestion and electrothermal atomization-AAS. The results are compared, for some metals, with 2 other methods of oil treatment: extraction with HNO_3 , and dilution with methyl isobutyl ketone. Both the extraction and dilution procedures appeared to measure only the loosely bound, inorganic portion of the metals: detn. of the total metal content including organometallics required wet digestion. The crude oil contained the largest metal burden but successive refining steps reduced the metal content to a level which met the FAO/WHO Codex standards. Hydrogenation did not significantly alter the metal concn. in the oils. AS

50

[Secondary contamination with toxic elements in meat and meat products.] Sekundärkontamination mit toxischen Elementen in Fleisch und Fleischwaren.

Hecht, H.; Schramel, P.; Moreth, F.; Schinner, W.

Fleischwirtschaft 61 (9) 1316, 1318, 1321-1325; 1365 (1981) [19 ref. De, en] [Bundesanstalt für Fleischforschung, 8650 Kulmbach, Federal Republic of Germany]

Sources of secondary heavy metal contamination of meat and meat products, and their toxicological importance are reviewed, i.e. technological contamination (from machinery, storage containers, processing equipment), additives (herbs, salts, emulsifiers, cutting aids), packaging materials, and special sources (lead shot). While processing equipment did not usually produce significant Pb, Cd and Hg contamination, it could increase levels of Fe, Cu and Zn through abrasion. Contact with Zn-coated surfaces should be avoided. Significant metal residues were produced from lead shot (splinters or abrasions) and should be the subject of further study: 0.11-159 mg/kg Pb, 5.5-59.6 µg/kg Cd, 2.1-10.9 mg/kg Cu were isolated from 20 samples of the diaphragm of shot deer. RM

51

[Contents of lead, mercury and cadmium in the daily diets of children in nursery schools.]

Koktycz, N.; Bulinski, R.

Bromatologia i Chemia Toksykologiczna 13 (2) 215-216 (1980) [4 ref. Pl] [Zaklad Bromatologii Inst. Anal. i Tech. Farmaceutycznej Akad. Med., Lublin, Poland]

52

[Separation of toxic heavy metals from solutions by means of chelating cellulose exchangers.]

Abtrennung von toxischen Schwermetallen aus

Lösungen mit chelatbildenden Celluloseaustauschern.

Goldbach, K.; Lieser, K. H.

Zeitschrift für Analytische Chemie 311 (3) 183-186 (1982) [14 ref. De, en] [Tech. Hochschule Darmstadt, Hochschulstrasse 4, D-6100 Darmstadt, Federal Republic of Germany]

Separation of trace elements (Hg, Cd, As, Mo, Cr) on 3 cellulose exchangers with chelating anchor groups is described. Enrichment of these trace elements from drinking water facilitates control of max. legally-permitted concn. DIH

53

[Determination of cadmium by flameless atomic-absorption spectroscopy. II. Modification of graphite furnace tubes by Al_2O_3 .] Bestimmung von Cadmium durch flammenlose Atom-Absorptions-Spektralphotometrie. II. Modifikation des Graphitrohrofens durch Al_2O_3 .

Severin, G.; Schumacher, E.; Umland, F.

Zeitschrift für Analytische Chemie 311 (3) 205-208 (1982) [6 ref. De, en] [Anorganisch-Chem. Inst. der Univ. Corrensstr. 36, D-4400 Münster, Westfalen, Federal Republic of Germany]

Influence of treating graphite furnace tubes with Al_2O_3 on detn. of Cd by flameless AAS was investigated. Best results were obtained by direct addition of 0.02N $\text{Al}_2(\text{NO}_3)_3$ to the samples. Resultant formation of $\gamma\text{-Al}_2\text{O}_3$ prevents premature loss of Cd, allowing destruction of the organic matrix, obviating the need for sample pre-treatment. The method was successfully applied to Cd detn. in 7 beer and 7 wine samples. S.d. was 1% (11 detn.), recoveries were approx. 100%. None of the samples exceeded the recommended limit of 20 parts Cd/billion. [See *Zeitschrift für Analytische Chemie* (1982) 311 (3) 201-204 for part I.] RM

54

[Increasing cadmium content in grain?] Steigende Cadmiumgehalte in Getreide?

Lorenz, H.

Bundesgesundheitsblatt 24 (2) 30-31 (1981) [9 ref. De]

Reports concerning the cadmium contents of grains, principally wheat, are briefly reviewed in the light of the hypothesis that with the increasing use of Cd in industry, levels in the soil and in food crops are also rising. JRR

55

[Changes in heavy metal contents in plaice, whiting, sprat and brown shrimps from Belgian coastal waters.]

Vyncke, W.; Vanderstappen, R.; Clerck, R. de;

Moermans, R.; Hoeyweghen, P. van

Revue de l'Agriculture 34 (5) 1351-1365 (1981) [38 ref. Fr, en] [Sta. de Peche Maritime, Ankerstraat 1, B-8400 Oostende, Belgium]

Hg, Zn, Cu, Cd and Cr were determined between 1972 and 1978 in representative marine organisms from Belgian coastal waters. Tabulated results showed no clear trend for any metal. Mean values (mg/kg) were

0.12–0.15 Hg, 7.3–23.6 Zn, 0.72–1.32 Cu in the fish sp., 0.09, 29.6 and 15.5 resp. in shrimps. Cd and Cr contents were low, with about 30% of the results below the detection limit of 0.01 and 0.1 mg/kg resp. Methyl-Hg accounted for 62% of total Hg in sprats, 85–88% in the other 3 sp. Mean Hg contents in the liver of plaice and whiting were 0.09 and 0.07 mg/kg resp. No significant correlations were found between the various heavy metals, and between metal concn. and biological parameters (age, size, wt., condition, somatic index of the liver), except for a correlation between Hg in liver and age of plaice ($r = 0.478$). While the metal concn. were higher than those found in the open sea, they give no cause for concern. [From En summ.] RM

56

[Distribution of trace amounts of heavy metals in short-necked clam and sludge in Tokyo Bay (1978–1979).]

Horii, S.; Yamagishi, T.; Miyazaki, T.; Kaneko, S.; Murakami, H.

Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 31 (1) 156–160 (1980)

[6 ref. Ja] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo, 160 Japan]

Short-necked clams were sampled at a number of locations in Tokyo bay in 1978 and 1979 and analysed for contents of 7 heavy metals. Results are tabulated for each location. Overall means for both yr (53 samples), with s.d. (p.p.m., wet basis), are as follows: Pb 0.13 ± 0.11 ; Co 0.14 ± 0.05 ; Zn 23 ± 5 ; Cd 0.04 ± 0.02 ; Cu 1.1 ± 0.3 ; Hg 0.104 ± 0.050 ; As 1.52 ± 0.48 . Correlation coeff. between heavy metal concn. are tabulated, as are corresponding data on Tokyo bay sludge. [From En tables.] DIH

57

[Heavy metals in fishery products – a review.] Die Belastung von Fischereierzeugnissen mit Schwermetallen – ein aktueller Überblick. [Review] Schreiber, W.

Archiv für Lebensmittelhygiene 32 (5) 145–149 (1981) [many ref. De, en] [Bundesforschungsanstalt für Fischerei, Hamburg, Federal Republic of Germany]

Published data on heavy metal contents in marine and fresh water fish and shellfish products in Germany are reviewed. Tabulated data for Hg, Cd, Ag, As, Zn, Co, Ni, Se, Pb and Cu suggest that there is no need to establish new limits for max. contents. RM

58

[Transfer of cadmium from feed to beef kidneys, liver and muscle.] Zum Übergang von Cadmium aus dem Futter in Nieren, Lebern und Muskulatur von Schlachtrindern.

Kreuzer, W.; Bunzl, K.; Kracke, W.

Fleischwirtschaft 61 (12) 1886–1894 (1981) [43 ref. De,

en] [Inst. für Tierärztliche Nahrungsmittelkunde, Univ. Giessen, D-6300 Giessen, Federal Republic of Germany]

The effect of Cd intake on its level in liver, kidneys and muscle was investigated in 143 cattle of various ages (up to 7 yr) and sexes. Tabulated results are shown for daily Cd intakes of 2.6–10.2 mg, Cd contents in kidneys 0.23–2.83, liver 0.09–0.88 and muscle < 0.005 mg/kg fresh wt. Cd contents in kidneys were correlated with the levels in feed at the 95% significance level in younger animals and showed a trend towards positive correlation in older animals. Cd contents in kidneys and sometimes liver were linearly correlated with age. With a mean Cd content < 0.88 mg/kg DM in the feed, Cd levels of 0.50 mg/kg fresh wt. were not exceeded in the livers of young bulls, or 0.005 in the muscle of young bulls and cows. The guide value for kidney was exceeded considerably in $> 20\%$ of the cows, especially in older animals (max.

3.18 mg/kg, vs. 0.88 in liver < 0.005 in muscle). As a result, it does not seem practicable to lay down max. Cd values for kidneys. Max. values are suggested for Cd levels in feed. RM

59

Determination of cadmium in foods of animal origin by atomic absorption spectrophotometry after separation by ion exchange resin.

Campanini, G.; Dazzi, G.; Madarena, G.

Rivista della Società Italiana di Scienza

dell'Alimentazione 10 (2) 89–92 (1981) [12 ref. En, it]

[Istituto Policattedra di Ispezione degli Alimenti di Origine Anim., Univ. di Parma, Parma, Italy]

A method for detn. of Cd in foods of animal origin is described, based on dry-ashing in a muffle furnace at 450°C , extraction of Cd from the ash by boiling with HNO_3 , neutralization of the extract with NH_4OH , separation of Cd on a Chelex-100 ion-exchange column (Cd being eluted from the column with 1M HNO_3), and detn. of Cd in the eluate by flame AAS. This method was applied to a range of foods; mean % recoveries were: raw ham 99.61; Bologna sausage 96.99; tuna in olive oil 95.71; salted sardines 99.21; milk 97.43; Parmigiano cheese 98.91; and eggs 100.54. Natural Cd contents were in the above order ($\mu\text{g/kg}$); 16; 28 and 42 (2 samples); 19 and 29 (2 samples); 97; 41; 55; and 59. Analysis time for single samples is 45 min. AJDW

60

[Determination of copper, lead and cadmium in tea by graphite furnace atomic absorption spectrophotometry.]

Tsushida, T.; Takeo, T.

Journal of Japanese Society of Food Science and Technology [Nippon Shokuhin Kogyo Gakkaishi] 27 (11) 585–589 (1980) [15 ref. Ja, en] [Nat. Res. Inst. of Tea, 2769 Kanaya, Kanaya-cho, Haibara-gun, Shizuoka-ken, Japan]

Cu, Pb and Cd were determined in tea samples ashed at 500°C by graphite furnace AAS. Extraction of the metals by the iodide-MIBK procedure removed interferences by other ions. Detn. of Cu, Pb and Cd in 54 samples from various districts gave mean levels of 11.9, 0.31 and $0.023 \mu\text{g/g}$, resp. [From En summ.] JRR

61

[Study on amounts of trace elements in marine fishes. V. Distribution of heavy metals and arsenic in flatfish graymullet and gizzard-shad tissue.]

Katsuki, Y.; Ishii, H.; Itoh, A.; Naoi, Y.; Kimura, Y. *Annual Report of Tokyo Metropolitan Research Laboratory of Public Health* 31 (1) 174-179 (1980) [23 ref. Ja] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakunincho 3 chome, Shinjuku-ku, Tokyo, 160 Japan]

Concn. of As and heavy metals in muscles and internal organs of the 3 title fish spp. are tabulated (in En) as means and ranges. Mean concn. in (i) flatfish muscle (33 samples) (ii) and (iii), white and red muscle, resp. of grey mullet (12 + 12) and (iv) and (v) white and red muscle, resp. of gizzard-shad (20 + 20) were as follows (p.p.m. wet basis) for (i)-(v) resp.: total Hg 0.05, 0.02, 0.02, 0.02, 0.02; Pb 0.07, 0.07, 0.06, 0.12, 0.13; Cd 0.01, 0.01, <0.01, 0.01, 0.02; Cr 0.06, 0.03, 0.04, 0.05, 0.03; Cu 0.20, 0.16, 2.1, 0.46, 2.9; Zn 4.6, 3.8, 9.0, 4.3, 8.8; Mn 0.10, 0.08, 0.13, 0.64, 0.81; Co 0.02, 0.03, 0.03, 0.02, 0.02; As 1.6, 0.37, 0.64, 0.34, 1.5. [From En tables.] DIH

62

[Studies on transfer of Cd from naturally contaminated feeds into animals. I. Cd-retention in muscle, liver and kidney, and Cd balance in fattening pigs fed wheat products with raised Cd contents. II. Cd retention in tissues and organs and Cd balance in fattening beef. III. Cd retention in muscle, liver and kidney of fattening lambs.] Untersuchungen zum Übergang von Cadmium aus natürlich kontaminierten Futtermitteln auf das Tier. I. Cd-Retention in Muskel, Leber und Niere sowie Cd-Umsatz bei Mastschweinen bei Verfütterung von Weizenprodukten mit erhöhtem Cd-Gehalt. II. Cd-Retention in Geweben und Organen sowie Cd-Umsatz bei Mastrindern. III. Retention von Cadmium in Muskel, Leber und Niere von Mastlammern.

Kögel, J.; Hofmann, P.; Rosopulo, A.; Knöppler, H.-O. *Landwirtschaftliche Forschung, Sonderheft* No. 37, Kongressband 1980, 346-358; 359-368; 369-372 (1981) [many ref. De] [Bayerische Landesanstalt für Tierzucht, D-8011 Grub, Federal Republic of Germany]

Feeding trials were done with slaughter animals given varying levels of Cd in the feed (supplied by grain grown on fields repeatedly fertilized with clarified sludge). Tabulated results showed that increasing Cd supply had little effect on fattening and slaughter performance or on Cd contents in meat, but significantly increased Cd in liver and kidneys, from 0.104 p.p.m. fresh matter in controls (Cd in feed 0.26 p.p.m. in DM) to 0.391 (Cd in feed 1.85 p.p.m.) in pigs' liver, and from 0.41 to 2.99 in kidneys; from 0.05 p.p.m. in controls (Cd in feed, total for 4 wk 308 mg) to 0.82 (Cd in feed 3880 mg) in beef liver, and from 0.21 to 1.52 in beef kidneys; from 0.055 p.p.m. in controls (<0.1 mg total Cd in feed) to 1.38 in lambs' liver (345 mg Cd in feed), and from 0.084 to 1.50 in lambs' kidneys. RM

63

[Evaluation of risks associated with use of anti-fouling paints in mollusc-culture areas.]

Alzieu, C.; Thibaud, Y.; Heral, M.; Boutier, B. *Revue des Travaux, Institut des Peches Maritimes* 44 (4) 301-348 (1980) [57 ref. Fr] [Dep. Environment & Ecosystemes, Inst. Sci. & Tech. des Peches Maritimes, 44031 Nantes Cedex, France]

This paper on possible contamination of oysters by toxic substances derived from antifouling paints includes tables of data for levels of Pb, Cd, Cu, Zn, Fe and Sn for digestive glands, gills, adductor muscle and shell of oysters from various sites in the vicinity of Brest, Lorient, Marennes-Oleron, Arcachon, and Saint-Jean de Luz. The relation of levels of these metals in the tissues to the local industrial or dockyard-derived pollution is discussed. AJDW

64

[Accumulation and excretion of dietary cadmium (Cd) in cattle, and a survey of the Cd content in the organs of cattle produced in the Tohoku district.]

Tsuneishi, E.; Takeshita, K.; Yoshida, S.; Nishimura, K. *Bulletin of the Tohoku National Agricultural Experiment Station [Tohoku Nogyo Shikenjo Kenkyu Hokoku]* No. 65, 157-165 (1981) [30 ref. Ja, en]

Excretion and accumulation of Cd were investigated in 2 Holstein steers fed a concentrate with added Cd compounds (300 mg/day, as CdCl₂) and contents of Cd were also determined in body tissues of 18 beef cattle from 5 different locations in Tohoku district. High intake of Cd increased tissue Cd levels, especially in kidney (64.18 p.p.m., fresh basis) and liver (17.11 p.p.m.); concn. in muscles was not affected and remained very low (0.03 p.p.m. and not detected). [From En summ.]

AL

65

Additives and contaminants in the food supply.

Elton, G. A. H.

Food Technology in Australia 33 (4) 184-188 (1981) [11 ref. En] [Min. of Agric., Fisheries & Food, London, UK]

The problems of ensuring that the nation's food supply is wholesome and safe are discussed. The assessment of short-term and long term hazards, and the toxicological testing of food additives are briefly considered. Examples considered are: the use of sodium nitrite as a meat curing additive; the use of saccharin as a sweetener; the presence of heavy metals as contaminants; and the presence of aflatoxin in mould infested foodstuffs. VJG

66

[Removal of heavy metals in water treatment.]

Zacek, L.

Vodni Hospodarstvi, B 31 (10) 255-258 (1981) [14 ref. Cs, ru, en] [Res. Inst. of Water Management, Prague, Czechoslovakia]

In the treatment of drinking water, the presence of heavy metals (Hg, Pb, Cr, Cu, Cd, Ni, Zn and sometimes

As) is a formidable problem in industrial environments. Results of 5 yr testing show that the most suitable means for eliminating them is (i) alkaline clarification with ferrous sulphate, (ii) decarbonization and (iii) sorption on activated carbon. To achieve high efficiency with (i) and (ii) the pH must be high enough for heavy metals to be present in insoluble form. Effect of (iii) is very dependent on type of sorbent, dosage, and filtration rate. The correct choice of the appropriate technological procedure for removing heavy metals is also dependent to a considerable degree on the type and concn. of heavy metal concerned, as well as on the overall composition of the raw water. STI

67

[The contents of heavy metal in fruits and vegetables collected from Jinju district.]

Kim, M. C.; Sung, N. K.; Shim, K. H.; Lee, M. H.; Lee, J. I.

Korean Journal of Food Science and Technology 13 (4) 299-306 (1981) [22 ref. Ko, en] [Dep. of Food Sci. & Tech., Gyeongsang Nat. Univ., Jinju 620, S. Korea]

Contents of heavy metals in fruit and vegetables collected from Jinju in Korea during June 1980-March 1981 were determined by AAS. Results are tabulated and statistically analysed. Moisture % was 65.3 in garlic to 95.9 in cucumber; Cu was (mean p.p.m.) 0.310 in cucumber to 1.821 in pepper; Pb was (mean p.p.m.) 0.423 in tomato to 1.082 in pear; Zn (mean p.p.m.) was 0.625 in tomato to 10.252 in radish; Ni was (mean p.p.m.) trace in cabbage, carrot and sweet potato to 0.353 in tomato; Hg was (mean p.p.m.) trace in cucumber, tomato, and pepper to 0.204 in lettuce; Cd was (mean p.p.m.) 0.021 in pear, lettuce and cabbage to 0.113 in radish; Mn was (mean p.p.m.) 0.907 in tomato to 16.122 in water celery; Fe was (mean p.p.m.) 0.397 in tomato to 19.916 in spinach. [From En summ.] LH

68

[Contamination of foods with Pb and Cd. Analysis of meat products.]

Bolasco, A.; Memoli, A.; Botre, C.

Rivista della Societa Italiana di Scienza

dell'Alimentazione 10 (3) 147-152 (1981) [20 ref. It, en] [Cattedra di Chimica Fisica, Univ. di Roma, Rome, Italy]

Data are presented for concn. of Pb and Cd (determined by AAS) in samples of beef muscle, spleen, kidneys and liver; veal muscle, spleen, kidneys, liver, heart, lungs, intestines and sweetbreads; chicken muscle and liver; turkey muscle; and pork muscle, spleen, liver, kidneys, raw ham and sausages. Max. Pb concn. recorded (p.p.m.) were 4.3 in beef liver, 4.2 in beef muscle, 4.5 in raw ham, 4.2 in pork kidney and 4.1 in pork liver. Max. recorded Cd concn. (p.p.m.) were 1.42 in beef kidney, 0.87 in veal kidney and 0.68 in pork kidney. The results are discussed in relation to FAO-WHO recommended monthly intakes; it is calculated that intakes of Pb and Cd in Italy may be resp. 195% and 180% of the FAO-WHO recommended levels. AJDW

69

[Toxic metals in raw materials and products of the meat industry.]

Dordevic, D.; Milohnoja, M.; Dujic, I.; Radovic, N.

Tehnologija Mesa 22 (11) 312-315 (1981) [15 ref. Sh, en] [Jugoslovenski Inst. Tehnologiju Mesa, Belgrade, Yugoslavia]

Muscle, fatty tissue, kidneys and liver of cattle and pigs, and canned hams and pork shoulders, were analysed for As, Sb, Cd, Hg, Pb and Se. Data are given for the proportions of samples in which heavy metals were found, and for mean and max. concn. detected (with s.d. and coeff. of variation). Levels of heavy metals in the canned products were within tolerance limits. 13 additives commonly used in meat processing were also analysed. STI

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